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Poultry, HPAI and Livelihoods in Lao People's Democratic Republic – 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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Keywords

Avian Flu, Chickens, Ducks, Highly Pathogenic Avian Influenza, HPAI, Livelihoods, Markets, Market Shocks, Poultry, Poultry Production, Poverty, Smallholder Farms, Smallholders, Southeast Asia, Lao People's Democratic Republic.

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 Lao PDR; 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

Lao PDR's economy is heavily reliant on agriculture. Agricultural activities absorb four-fifths of the work force, mostly as low- or no-pay family labour, and account for two-fifths of GDP. Most agricultural outputs (90%) come from smallholder production systems. Rice is the most important crop and rice fields are an abundant feed resource for free-grazing waterfowl. Cattle, buffaloes, pigs, chickens and goats are raised for their cash income potential, especially as national, regional and international demand for meats is rapidly increasing. Government is aiming for sustained GDP growth through promotion of domestic production, foreign investments and exports of minerals and energy to neighbouring trade partners. Current negative trade balances are being addressed through regional and international integration schemes that improve terms of trade and the expansion of commercial relations with China, Japan and Viet Nam.

Lao PDR's Poultry Industry

The poultry population totals 21 million birds. Chickens and ducks are the major species raised, while geese, turkey, pigeon and quail inventories are marginal. Four-fifths of all birds are kept in central and northern regions, with the highest poultry and human densities in Vientiane Capital province. Three main poultry production systems co-exist: (A) traditional, small-scale, extensive backyard poultry production, accounting for around 84% of the national poultry flock, (B) semi-intensive, small- to medium-scale, market-oriented, commercial poultry production, and (C) intensive, large scale, industrially-integrated poultry production. The current level of poultry production equates to 3.1 kilograms of poultry meat available annually per person.

Poultry and Livelihoods

Four-fifths of Lao PDR's working population earn less than 99 dollars/month. Latest poverty headcounts reveal poverty is particularly prevalent in the highlands, whereas the Vientiane plain has the lowest poverty levels owing to its primary infrastructure and urbanization. Poultry and poultry product sales contribute less than one-fifth to overall household income, however, this masks to who within a household the income from poultry accrues, as it is an important source of cash income for women. The average national level of dietary energy consumption is 2,090 kilocalories per person per day, of which seven-tenths are provided by cereals, with variations by location and by income quintiles. Laotians consume from 30 to 40 grams of meat per person per day, and of these, 8.2 to 9.7 grams are poultry meats.

The HPAI Epidemic: Course and Institutional Response

From 2004 to 2008, Lao PDR registered 13 HPAI outbreaks comprising a little over 156,000 bird deaths due to disease and culling. Eight of the thirteen outbreaks occurred in February-March 2007, mostly in Vientiane Capital province (62%) and predominantly in commercial farms, losing as much as one-fifth of the national layer flock. Two fatal infections in humans also occurred in this timeframe. A series of emergency control measures were instituted: poultry movement restrictions, poultry import bans from Thailand, enhanced border trade inspections, media campaigns to raise public awareness, protection and surveillance zones around outbreaks, and a stamping-out policy for all birds within 3 kilometres of identified outbreak sites. The five border checkpoints with Thailand remain vigilant to

incoming poultry imports, but effective policing of cross-border trade proves challenging. In response, grassroots approaches to disease surveillance are now applied.

Social and Economic Impact of HPAI and Control Measures

Immediate direct impacts from morbidity and mortality caused by HPAI and from control measures applied by private and public sectors resulted in direct monetary losses of roughly US\$235,000. Traders, intermediaries, and market sellers experienced income reductions ranging from 20 to 40 percent during the four weeks following an outbreak. Laotian consumers were reluctant to buy and consume poultry meats and eggs due to fears of contracting disease, leading to reduced demand for poultry products and increased demand (and prices) for alternative meats. The production sector was impacted by government-mandated poultry input import bans from Thailand and Viet Nam that caused prices of day-old chicks to rise from LAK 3,000 (US\$0.35) to LAK 5,000 (US\$0.59), while the price for ducklings remained at LAK 4,000 (US\$0.47). Also, after outbreaks, some producers switched partially or completely from poultry into fish farming, cattle, and hog production; while other farmers temporarily kept low production profiles that lowered demand for feeds, which in turn affected feedstuff purveyors and grain sellers. Overall, the socio-economic threats of HPAI for Lao PDR are not so much through the immediate impacts of outbreaks so far experienced but more through the opportunity costs of poultry sector development.

Conclusions

In Lao PDR, local indigenous varieties command a price premium vis-à-vis commercially produced broilers, and given the growth in demand for poultry products and the premium for traditional varieties, there is scope to promote extensive and intensive poultry production systems through appropriate policy incentives. With this in mind, a market-driven, self-financed, certification programme for HPAI-free birds could foster considerable quality improvement among small-scale producers, middlemen and retailers, while at the same time sparing significant fiscal outlays. This, in combination with an incentive-based passive surveillance systems using trained village veterinary workers reporting to animal health officials, complemented with rapid disease investigation could result in a pragmatically low-cost and sustainable approach to monitor HPAI nationally. Regardless of approach, a strong focus on the poorest and least resource-endowed population groups is crucial.

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 affected by HPAI, Lao PDR being one of these. The document is divided into six sections. The first section deals with Lao PDR 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 Cambodia 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 provides some preliminary conclusions on the issues that need to be tackled for Lao PDR’s poultry sector to successfully develop in the aftermath of HPAI.

Macroeconomic Overview

The focus of Lao PDR's current economic policy is to achieve annual GDP growth rates of 8 percent in the next 5 years through promotion of domestic production, foreign investments and exports.

Despite concerns of global economic deceleration, real economic growth in Lao PDR is set to remain fairly healthy at an average of 6.5 percent a year for 2008-2009, although this will represent a slightly slower pace of growth than that recorded in 2006-2007 (Table 1).

The Asian Development Bank remains optimistic and forecasts an average annual GDP growth of 7.8 percent fuelled by strong demand for minerals and energy in neighbouring trade partners, such as Thailand and China.

Table 1. GDP, human population, *per capita* GDP and GDP growth, 2002 to 2008.

Description	2002	2003	2004	2005	2006	2007	2008 est
GDP-PPP****	9.20	9.90	10.32	10.79	11.38	12.23	13.02
Population***	5.78	5.92	6.07	6.22	6.37	6.50	6.70
<i>per capita</i> GDP**	1,592	1,672	1,700	1,735	1,787	1,882	1,943
GDP growth (%)*	-	7.61	4.24	4.55	5.47	7.50	6.50

Source: The Economist Intelligence Unit, The World Bank, CIA World Factbook, International Monetary Fund – 2008.

Note: **** purchasing power parity in billion US\$; *** in millions; ** in US\$; * growth over previous year.

Although a slowdown in world trade on Asian economies has been accounted for in estimates, Lao PDR's energy and mining exports remain strong. Exports of electricity are rising in line with growing demand in Southeast Asia, and gold and copper exports continue increasing as new mining sites are being developed. According to the ministry of energy and mining, these sectors are growing by 20 percent annually and now account for 6.2 percent of GDP (Economist, 2008).

Lao PDR is trying to comply with a U.S. bilateral trade agreement whose requirements are the same as those needed for WTO membership. Meanwhile, tariffs are being progressively lowered for the ASEAN free trade area, with China signing agreements conferring preferential trade tariffs (Sirikeratikul, 2006).

Despite rising exports in various sectors, the IMF's International Financial Statistics report that first quarter 2008 exports rose by just 0.5 percent on a year-by-year basis to US\$258.2 million. In this same period, imports remained unchanged from a year earlier and amounted to US\$261.1 million.

The resulting trade balance is negative, and by early 2009 the current-account deficit will widen to almost 8 percent of GDP. In response, the government insists on pushing ahead with its policy of regional and international integration to boost trade, while strategically maintaining close ties with the ruling communist parties in neighbouring China and Viet Nam. To its advantage, international affairs policies are firmly based on non-interference and peaceful negotiation over sensitive issues.

As in other parts of the world, commodity prices and transport costs are rising in Lao PDR. According to IMF datasets, inflation in Lao PDR stood at 7.7 percent in March 2008, while the National Statistics Division of the Ministry of Planning and Investment reports 5 percent.

Similar to other governments in the region, Lao PDR monetary policymakers are struggling to control inflation. Forecasts for annual average inflation in 2008 have been corrected from 4.5 percent to 7.8 percent, following upwards revisions on global forecast for commodity prices.

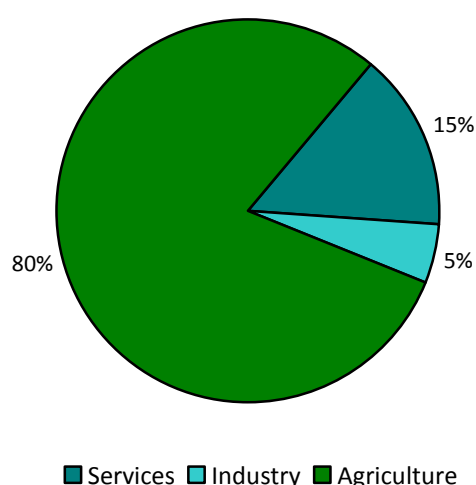
The latest economic indicators suggest that inflationary pressures in Lao PDR are rising, with food and fuel prices increasing steeply in most rural areas. This is particularly worrisome for Southeast Asian countries which have traditionally sought to control fuel prices. Although the government had abandoned fuel subsidies several years ago, it still caps prices and its review system is rather slow to respond to brisk fluctuations.

Faced with an uncertain environment, the government response is to attempt to improve its fiscal performance by meeting revenue targets and reigning in money supply growth, which is up by 53 percent from the previous year and continues to increase. Additionally, central bank authorities are fiercely preventing a dramatic shift in the Kip's value against the US Dollar and the Thai Baht, which has continually strengthened over the past year (Economist, 2008).

Politically, the powerful ruling Lao People's Revolutionary Party is set to remain firmly in control, with no serious challenge to its authority likely to emerge. For the time being, accelerating inflation - especially for staples and fuel- has failed to provoke any vocal protest or populous revolts among Lao people.

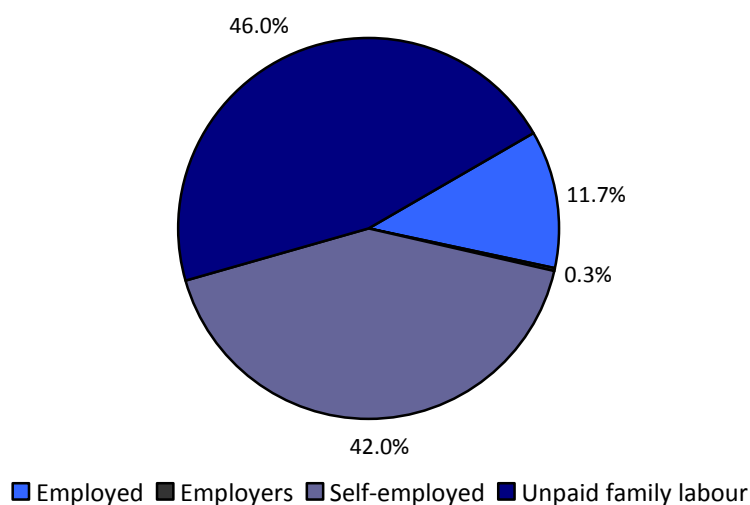
Four fifths of the labour force in Lao PDR is involved in agricultural-related activities (Figure 1) with the industry and services sectors sharing the remainder. This distribution is similar to neighbouring Cambodia, making both of these overwhelmingly agriculture-oriented nations.

Figure 1. Labour force by economic sectors, Lao PDR, 2005.



Source: National Statistics Centre, 2008 using data from the Ministry of Labour and Social Welfare, 2005.

Similar to Cambodia, the general employment status of Lao PDR reflects heavy reliance on unpaid family labour (46%). Two fifths of the workforce is self-employed (most likely earning variable incomes), close to 12 percent is formally employed, and only 0.26 percent are employers (Figure 2).


Figure 2. General employment status, Lao PDR, 2005.

Source: National Statistics Centre, 2008 using results from the Population and Housing Census, 2005.

The latest unemployment data in 2005 suggest that only 2.4 percent of the economically-active workforce is without jobs. This is arguably a very low value considering that literacy is currently estimated at around 50 percent, and only 71 percent of primary school-aged children are in school. Furthermore, The World Bank reports that over one third of educated Laotians live abroad.

Box 1. Country Facts

Official Name	Lao People's Democratic Republic		
Government	Socialist Republic		
Capital City	Vientiane		
Area	236,800 sq km		
Population (2008 est.)	6.7 million		
Population (2007 est.)	6.5 million		
Population Density	28 per sq km		
Urban Population	20%		
Rural Population	80%		
Religion	Theravada Buddhism		
Language (official)	Lao		
Currency	Lao Kip (LAK)		
Life Expectancy	55 Years		
Inflation Rate	4.75%		
HDI [as published in 2007]	0.601		
General Economic Indices			
GDP-2007 [PPP*]	US\$12.65Bn (IMF); US\$11.40Bn (WB); US\$12.65 (CIA); US\$12.23 (Average)		
GDP-2007 <i>per capita</i>	US\$1,946 (IMF); US\$1,754 (WB); US\$1,946 (CIA); US\$1,882 (Average)		
	<u>2005</u> <u>2006 rev.</u> <u>2007 est.</u>		
Agriculture-GDP	44.4%	42.2%	41.3%
Industry-GDP	29.2%	31.5%	32.2%
Service-GDP	25.5%	25.4%	26.5%





Sources: The World Bank, CIA World Factbook, International Monetary Fund, Annex 1; * Purchasing Power Parity.

Agriculture

Lao PDR's economy is primarily agriculture based, with agricultural outputs accounting for 41.3 percent of GDP in 2007 (Box 1). Close to 2 million individuals are involved in agricultural work. The latest agricultural census reveals that four fifths of the total population is engaged in farm-related activities. Only one fourth of agricultural households have 2 hectares or more (average land holding is 1.62 hectares) and two fifths of households have less than 1 hectare, with 97 percent land ownership by farmers. Tree farming is economically important, as 23 percent of farms have mangoes, 17 percent coconuts, 11 percent jackfruits, 17 percent bananas, and 11 percent tamarinds.

The top 5 crops by production volume are: rice, vegetables and beans, sugarcane, starchy roots, and tobacco; and the major agriculture product exports by value are: timber, lumber, plywood, and coffee. Agriculture has benefited tremendously from increased competition in the banking sector, made possible by changes in banking laws, because banks are now providing first-time credits to many smallholder farmers and small-scale entrepreneurs.

Rice production accounts for most of the land under cultivation, and close to 93 percent of the area devoted to rice production is for sticky rice, a subsistence crop used mainly for home consumption.

Lao PDR grew around 2.7 million tonnes of rice in 2007, yet is not a rice exporting country. The government's agricultural policy in recent years has encouraged a move away from rice towards cash crop production, often through use of foreign investment. However, the recent increase in global fuel prices has increased overall input prices and weakened agricultural development prospects. Despite impending uncertainty, agricultural growth will continue to be driven primarily by agricultural trade growth, increased investment from Lao PDR's neighbours and an expansion in livestock industries, the output of which has been growing steadily over the past decade (GoL, 2006).

Livestock

For rural smallholders, livestock keeping is a vital source of cash income, a means to accumulate assets, and a provider of inputs to crop production (i.e. manure and draught power). Cattle, buffaloes, pigs, chickens and goats are the most important indigenous livestock species in the country (Wilson, 2007b). Roughly 31 percent of farmers have cattle, 48 percent water buffaloes, 49 percent pigs, and 73 percent chickens. These are kept mostly under free-range conditions, where they graze on natural grasslands, in paddy fields after the harvest, on fallow lands and in forested areas. Also, smallholder farmers are engaged in diverse aquaculture activities (71% of farmers).

National, regional and international demand for meats is increasing, and there is growing potential for exporting livestock and their products to neighbouring countries. However, despite these opportunities, three fifths of farming households are engaged solely in subsistence agriculture; with only 6 percent of farmers selling their total output, and 35 percent selling some of their farm output.

The private sector is responding rapidly to market signals and economic incentives, with commercial pig, poultry, goat and dairy cattle farms emerging in and around cities in response to rising demand.

Currently, livestock support services, research and extension, marketing networks, transport and communication links, access to inputs and credit availability are all very limited and need to be improved to attain competitiveness beyond inexpensive labour force. The government has adopted a progressive livestock development plan to strengthen and promote animal production, provide alternative income strategies, and enhance national food security (GoL, 2006; FAO, 2007).

In 2006, the livestock and fisheries sub-sector contributed 15 percent to total GDP and almost 35 percent to agricultural GDP (Figures 3 and 4).

Figure 3. Contribution of agricultural sub sectors and others to total GDP, Lao PDR, 2006.

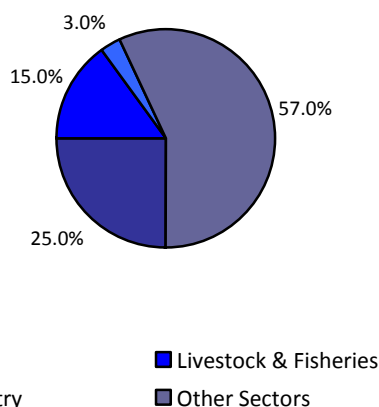
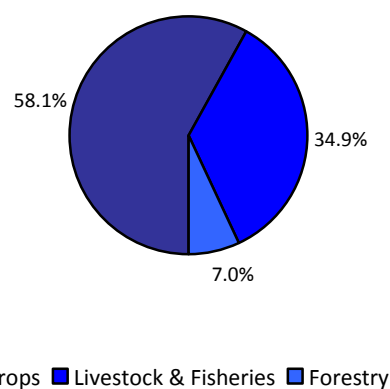


Figure 4. Contribution of agricultural sub sectors to agricultural GDP, Lao PDR, 2006.



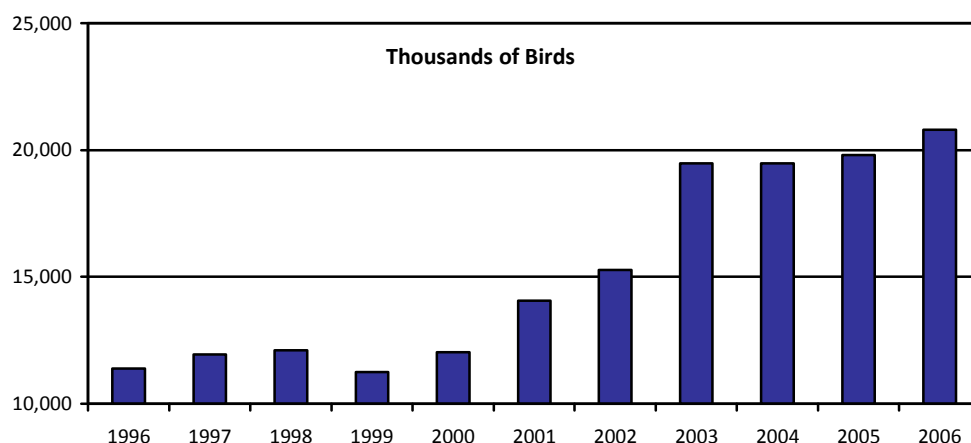
Source: National Statistics Centre, CPI, 2008 ; for more information see Annex 2.

It is worth mentioning that more than 90 percent of all agricultural outputs (livestock and crops combined) comes from smallholder production systems. This fact, coupled with its strategic geographical location, accentuates the potential that national livestock sector development policies and programmes can have in contributing to overall economic progress of the country (Wilson, 2007b).

Lao PDR's Poultry Industry

In Lao poultry production is dominated by smallholder backyard systems (17.5m birds; 84%), with a relatively small, semi-modern commercial production sector (3.3m birds; 16%). Poultry inventories have been rising steadily since 1999, from 11.2 million to 20.8 million birds in 2006 (with annual increases of 9.25%). After HPAI appeared in 2004, inventories rose only by 1.65 percent in 2005 due to uncertainty and reluctance to restock, but inventories have started to climb again (Figure 5).

Figure 5. Poultry population in Lao PDR, 1996-2006.

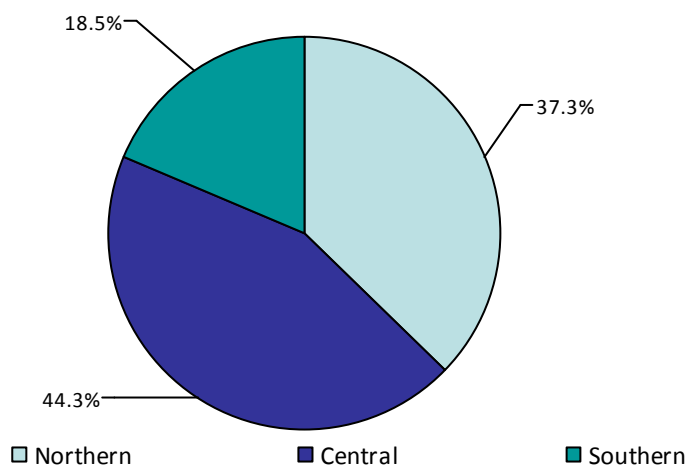


Source: National Statistics Centre, 2008 using data from the Ministry of Agriculture and Forestry of Lao PDR.

Current production only meets 80 percent of Lao's poultry demand, with the remaining 20 percent being imported from neighbouring countries either through smuggling or legal trade (Barennes *et al.*, 2007). Other species such as geese, turkeys, pigeons and quails are also raised rurally in commercial and non-commercial farms as alternative sources of food and income, but only constitute a very small proportion of the overall national poultry population (Wilson, 2007a).

It is said that more than 90 percent of Laotian households keep at least one species of poultry. A closer look at how poultry is distributed by regions in Lao PDR for 2001 is provided by Figure 6.

Figure 6. Distribution of total poultry population by three major regions, Lao PDR, 2001.



Source: JICA – MAF, 2001 as quoted by ILRI, 2002.

Note: For more information see Annex 5.

More than four fifths of the poultry population is concentrated in the northern and central regions, however, this generalization might be misleading for two reasons: i) some regions are bigger than others, and ii) low and high poultry-producing provinces within regions are mixed. A much closer look at poultry numbers by provinces reveals that poultry populations are highest in Champasack, Saravane, and Savannakhet (Table 2). However, Vientiane Capital province has the highest density of poultry at 943 birds per km². Comparatively, and in relation to 2006 human population, the highest populated provinces are Savannakhet (15%), Vientiane Capital (12%) and Champasack (11%).

The majority of ducks are found in the provinces of Vientiane, Khammouane, Borikhamxay and Vientiane Capital (FAO, 2008). Coincidentally, rice production is concentrated mostly in Champasack, Saravane, Savannakhet and Vientiane (Sirikeratikul, 2006), all of which provide feed resources to waterfowl kept under confined and free-range conditions.

Table 2. Highest and lowest poultry populations by province, Lao PDR, 2006.

Highest Poultry Provinces	% of Total	Lowest Poultry Provinces	% of Total
Champasack	17.2	Luangnamtha	1.6
Saravane	11.4	Attapeu	1.8
Houaphanh	11.0	Bokeo	1.8
Savannakhet	9.8	Phongsaly	2.6

Source: National Statistics Centre, 2008 using data from the Ministry of Agriculture and Forestry of Lao PDR.

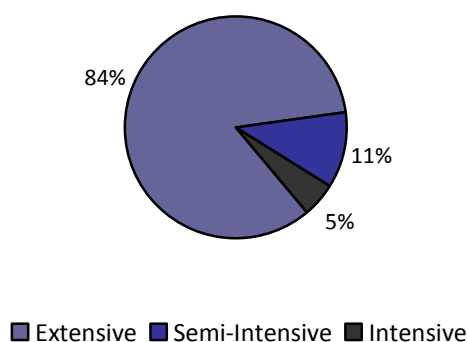
In urban areas population is growing rapidly, and this, coupled with people's rising incomes has raised demand for poultry meat and eggs. This demand growth for poultry products could be entirely met by national chicken and duck broiler and laying production, provided that domestic poultry sectors receive sustained government support. In 2004, poultry meat production was 19,800 tonnes, of which 17,959 tonnes (90%) came from household / backyard production while the remaining 1,841 tonnes (10%) came from commercial production. This production equates to an annual availability of 3.1 kg/poultry meat/person.

Chicken and Duck Production Systems

This report uses a threefold classification system to describe poultry production in Lao PDR: **(A)** traditional, small-scale, extensive backyard poultry production, **(B)** semi-intensive, small- to medium-scale, market-oriented, commercial poultry production, and **(C)** intensive, large scale, industrially-integrated poultry production.

Figure 7 displays the estimated distribution of birds by production system in Lao PDR for 2006.

Figure 7. Poultry population by production system in Lao PDR, 2006*.



Source: Authors' estimates based on National Statistics Centre, 2008 and Barennis *et al.*, 2007. *N ≈ 20.8 million.

Traditional, small-scale, extensive backyard poultry production

This type of production system accounts for a little over four fifths of the entire Lao PDR poultry population. Nearly all farmers in rural areas keep poultry, with women and children mostly responsible, handling an average flock size of 10 to 28 birds per household. Because Lao PDR is a country made up of small, geographically dispersed villages with only a few major cities, the average village counts with around 350 birds (this includes chickens, ducks, geese, turkeys, quails and pigeons) being raised in small flocks interspersed among village homes comprising about 50 to 70 families. These free-range birds scavenge for food in backyards, gardens, orchards and vacant lots, and, given the minimal cost this implies, they are widely kept in most provinces. Birds sleep in trees, underneath homes and natural sheds. The cost of inputs can be a very small cash expense for the purchase of day-old chicks, however, usually, when a mature chicken and cock are owned, there is no need to purchase day-old chicks because own-stock hatchlings are used. The recourse to vaccines, animal health products, feed additives or veterinary advice in this production system is low (Alders, 2004; Nicely, 2005; Wilson, 2007a).

Local gallinaceous birds have a live weight of 1.0 to 1.2 kg. Hens lay three to five clutches of 8 to 12 eggs per year providing an annual yield of 25 to 60 eggs, of which 80 percent hatch and 50 percent survive after 2 months. High mortality rates due to diseases (i.e. Newcastle, fowl cholera) are common in adult, mature birds. Ducks are the second most important species of poultry and include both Muscovy ('pet kab') and common duck ('pet thad'). Muscovy ducks are popular because they dependent less on water than common ducks, which are found almost exclusively in rice paddy areas. Muscovy males weigh up to 2.2 kg while mature females weigh 1.75 – 2.0 kg. Muscovy ducks lay one or two clutches of 10 to 20 eggs once or twice a year. Common ducks weigh up to 2 kg and lay three or four clutches of 10 to 12 eggs per year. Hatching performance for both duck species appears to be about 80 to 85 percent. Half or more of the ducklings die before three months of age. As shown in Table 00, other minor population of poultry are kept, such as turkeys ('kai ngouang' in Lao), Chinese geese ('han' in Lao), quails, geese and pigeons (Wilson, 2007 a, b for text and table).

Almost exclusively of local breeds, these birds are raised for meat and eggs (mostly consumed by the household) or sold locally for cash income in times of need. Chicken and duck eggs are either consumed or sold/traded. The cash raised from sales is used for medicines, education, garments and purchases of food items at shops and markets (Alders, 2004). Poultry raising is normally combined with other livestock keeping such as goats, pigs or cattle, but the degree in which this occurs depends on wealth status (Mondry, 2008).

Semi-intensive, small- to medium-scale, market-oriented, commercial poultry production

This type of production system carries from 50 to 1,000 birds and accounts for eleven percent of Lao PDR's poultry population. Housing varies from permanent to makeshift enclosures, with small quantities of feeds and plenty of water provided in plates, trays and bowls. Restocking occurs by hatching day-old chicks from own-stock. Gardens, backyards, orchards and vacant lots are often fenced to allow birds to be brought back in the evenings after scavenging for feeds or to remain enclosed. Production cycles for meat birds are of approximately 80 days, with moderate mortality rates and intermediate efficiency levels. Bio-security measures, although not comprehensive, are implemented to prevent disease occurrence, while sanitation, treatment and management are given more attention compared to small-scale, backyard production systems.

Production outputs consist of live birds, poultry meats and eggs. These outputs have more formal marketing avenues, such as local restaurant contracts, direct delivery to hotels, wholesaling to established middlemen and selling to experienced traders.

Because most of cultivated land in Lao PDR is devoted to rice, duck keeping, which is used for weeding out rice plots and to control pests, is also an important livestock enterprise. Duck raising

cycles coincide with rice production periods and these are usually raised outdoors near lakes and man-made ponds. Feeds are manufactured on-farm, and those that contain better quality ingredients are offered during the first two weeks of rearing while a transitional, lower-quality, fattening feed is provided afterwards. Duck plague (duck virus enteritis) is the main problem in ducks and affects Muscovies more than the common species. For the most part, medium-scale, semi-intensive commercial duck farms are less standardised than large-scale, intensive commercial chicken farms with ducks raised both as broilers and layers. Initial investments are higher than in small-scale backyard systems but lower than in large-scale, intensive systems (Wilson, 2007a, b).

Intensive, large scale, industrially-integrated poultry production

This type of production system uses flocks of 1,000 to 5,000 birds and accounts for around five percent of Lao PDR's poultry population. It normally uses commercially-designed and high production infrastructures that include more elaborate housing, feeding and drinking systems, and has much higher rates of commercialization. These operations provide birds with energy-dense commercial feeds, and restock by purveying day-old chicks locally or importing them from neighbouring countries, while specifically relying on replacement chickens from Thailand and ducks from Viet Nam (Wilson, 2007 a, b).

Broiler chickens are fattened for 6 weeks until reaching 1.75 to 2.0 kg, after which they are rendered, while layer chicken produce 250 to 270 eggs per year. The scale of on-farm employment depends on the number of houses, flock size per house, type of activities scheduled and availability of local labourers. This type of poultry production is capital and resource-intensive, with higher levels of investments in animal health, house maintenance, and biosecurity resulting in higher flock productivity compared to the previously described systems. It is estimated that up to 100 commercial operations (most of which are located near the capital) exist to service domestic demand in and around metropolitan areas (Wilson, 2007 a, b).

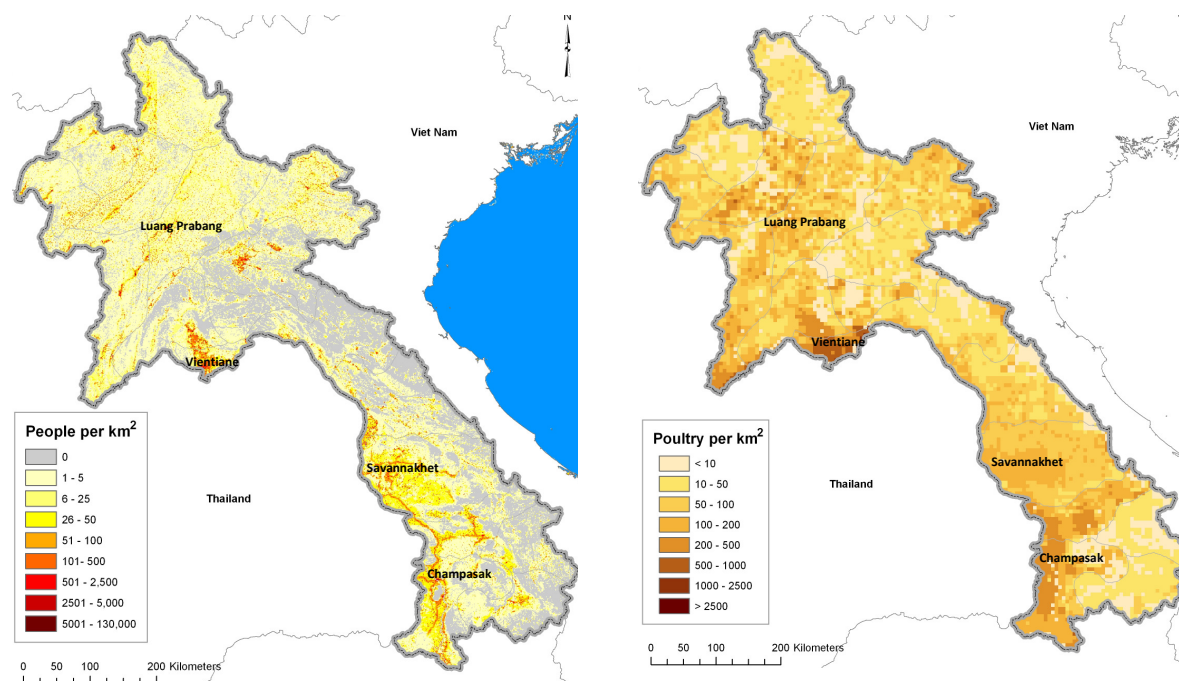
Commercial breeding farms and hatcheries: The commercial chicken and duck sectors have been, for the most part, historically dependent on the importation of genetic material. Breeding farms raise the parent stock that produce fertile eggs which, after incubation and hatching, pass chicks to the production sectors, mainly composed of broiler and layer/pullet farms. In Lao PDR, there is one broiler breeding farm with the capacity to produce one million day-old broiler chicks per year (with potential to expand to four million) and one layer breeding farm with capacity for 6,000 layer parent-stock (Wilson, 2007b).

These breeding farms were established in the late 1980s with financial aid from the Hungarian government and technical assistance of Japan. Grandparent and parent stocks were and are currently imported from the United States. In the years up to 1999, close to 700 thousand broilers and 250 thousand layers were reared each year in Lao PDR. However, in recent years, all layers have been imported because farms are no longer functional. Euribird Hisex (from Thailand) and Hendrix Bovan Goldline (from Holland) are among the most common layer lines imported (Wilson, 2007b).

Geographic Distribution of Human and Poultry Populations

In Lao PDR, as in most Asian countries, poultry densities directly correspond to human population densities with highest densities of humans and poultry in Vientiane province (Figures 8 and 9).

Figures 8 and 9. Estimated human and poultry population densities, Lao PDR, 2004 and 2006.



Source: Prepared by FAO, AGAL. For more information on poultry distribution see Annex 5.

Input Supply, Service Provision, and Marketing

Progressive poultry sector development in Lao PDR has enabled collateral businesses to gradually emerge in order to service the growing and varying needs of chicken and duck producers, be it in the form of livestock slaughtering, animal health services, financing, marketing or purveyance of inputs.

Commercial animal feed and veterinary product distributing stores

Commercial stores that supply animal feeds and veterinary products are located in and around Vientiane, Pakse, and Luang Prabang. These stores make a profit from buy-sell margins and procure animal feed and veterinary products in China, Viet Nam, Thailand and India. Many store owners are themselves livestock farmers.

Animal health services

Public animal health services in Lao PDR are scant. Although their official mandate is to promote the protection of productive assets, to advocate adherence to animal health principles and to reduce the likelihood of negative outcomes under a variety of husbandry and environmental conditions (Witt and Malone, 2005) these are, for the most part, unachievable under prevailing circumstances.

Mondry (2008) ascertains that the main constraint for controlling avian influenza and other avian diseases in Lao PDR is the limited capacity of veterinary services mainly due to the small number of qualified professionals and their low pay. As a result, local NGO initiatives and international public organizations have provided rural villagers and peri-urban dwellers with practical veterinary training, much of which takes place in the form of common disease recognition, vaccine applications and basic veterinary procedures. These trained individuals are referred to as veterinary village workers.

Private animal health professionals are more commonly seen in large-scale intensive poultry production systems and large livestock operations (ILRI, 2002). The reason for this is because they are either paid by consultation or paid as full-time employees of farm complexes. Most, but not all, have veterinary degrees, and others have been intimately involved with bird health for many years in the same location so as to be considered thoroughly trained and knowledgeable animal health practitioners. In fact, commercial poultry farms are the most notorious reporters of high poultry morbidity and mortality to government officials (Witt and Malone, 2005).

Financing and credit services

In Lao PDR, civil society, international and non-government organizations have played a pivotal role as financing entities in rural and urban settings (i.e. micro-credit, aid). Most of these organizations are chosen by international bankers (i.e. ADB, WB, IMF), foreign affairs programmes of donor countries, and charity accounts of multinational corporations to implement social, agricultural and environmental projects. They are selected based on positive independent evaluations, credibility, infrastructure, visibility, programme success rates, number of active staff, coverage and scope of reach. Most require farmers to submit formal credit applications, and these are followed by visits to their farms, subsequent follow-ups and verbal feedback. Commercial banks limit their credit facilities to established, financially-sound concerns and their risk exposures are partly covered by collateralized non-perishable assets. Like most of Asia, the commonest form of short-term credit is informally engaged and verbally agreed by wholesalers, feed retailers, hatcheries and suppliers.

Poultry and poultry product marketing

The majority of poultry outputs produced rurally are consumed by households based on needs. After satisfying family nutrition requirements, surpluses are destined for sale or distributed as gifts. When sales do occur, these take place either at farm gate to traders or directly to shops and markets (only when they are within close reach with each other). Similar to what is seen in neighbouring Southeast Asian nations, traders and middlemen are key agents in poultry product distribution and marketing. This process of moving food from farm to table is dynamically complex with a diversity of stakeholders interacting at every level in the supply chain. For example, traders own bicycles, motorcycles and cars to transport live birds, meat and eggs collected from farmers to food market retailers. Retailers, who gauge supply, demand and prices, sell to final consumers.

A typical farm-to-market cycle runs as follows: 1) Several bicycle-owning middlemen collect birds at farm gates of producers in their respective commune or village for a 2) motorcycle-owning middleman who himself, along with others, collects birds in communes, villages and towns, and transports longer distances for 3) a car-owning middleman that finally moves and sells the accumulated outputs from communes, villages, towns and districts to market retailers.

Abattoirs

Slaughterhouses in Lao PDR fall into 3 categories: (i) National, (ii) Regional, and (iii) Communal.

- *National* – constructed in 1972 and located in Donedu, Vientiane municipality, this is the only functional slaughterhouse. Animals are trucked from different regions in Lao PDR and from Thailand, where it processes varying quantities of cattle, buffalos, pigs, goats and poultry.
- *Regional* – these are located close to urban centres such as Champasack, Savannakhet, Pakse, and Luang Prabang. They consist of a concrete slab and roof, running water, light and rudimentary sewage systems. On a fee-basis they process small quantities of pigs, poultry, cattle, and buffalos (Mohammed, 2000).
- *Communal* – these are located in communes and villages, mostly for pigs and cattle, managed as a side business, without supervision by health officials (Mohammed, 2000).

Poultry and Livelihoods

The Laotian economy remains largely agrarian, with livestock playing an integral role in rural farming systems that include cattle, buffalo, pigs, goats, fish and poultry (chickens and ducks). More specifically, poultry are of considerable importance to the livelihoods of smallholder and village farmers, particularly so in remote mountainous areas (highlands) where it represents the main source of animal protein and provides for cash income in times of need.

Household Incomes

Incomes in Cambodia are said to be fairly equally distributed throughout all socioeconomic strata as evidenced by a low Gini coefficient of 34.6 for 2002. In this section, we use a fourfold classification of socioeconomic groups proposed by Baumann (2007) based on average monthly incomes assessed through forum group discussions and complemented with World Bank poverty figures.

These groups are: very poor, medium poor, medium rich and very rich. Table 3 shows estimated population distributions by monthly *per capita* incomes and socioeconomic groupings.

Table 3. Population distribution by monthly *per capita* incomes and socioeconomic groups.

Socioeconomic group	Income Range (US\$/Month)	Percentage of Population*
Very Poor	< 39	35
Medium Poor	40 – 99	45
Medium Rich	100 – 399	15
Very Rich	> 399	5

Source: Adapted from Baumann, 2007. * Authors' estimates based on World Bank poverty figures.

In line with recently revised World Bank poverty thresholds (Chen and Ravallion, 2008), the very poor – who are estimated to make up 35 percent of the population – earn up to US\$1.25 a day (up to 39 US\$/month). This group comprises landless farmers, mobile fruit, vegetable and handcraft sellers, and day labourers. They frequently own free-range poultry mainly for home consumption (NSC, 2005; Warr, 2005; Andersson *et al*, 2006; Baumann, 2007; Kim, 2007).

The medium poor, representing 45 percent of the entire population, are estimated to earn between 40 and 99 US\$/month. This group mainly comprises farmers with little land, producing food (rice) but not enough for subsistence, who also work as day labourers and raise small livestock (NSC, 2005; Warr, 2005; Andersson *et al*, 2006; Baumann, 2007; Kim, 2007).

The medium rich, comprising 15 percent of the population, earn between 100 and 399 US\$/month. Although they are similar in many ways to their medium poor counterparts, they tend to own more livestock in addition to being small shop owners, hotel employees, market sellers, tourist guides, teachers or drivers. Because of their legal land tenure, they derive more produce for sale, can rent out land, or use it as collateral for credit (NSC, 2005; Warr, 2005; Andersson *et al*, 2006; Baumann, 2007; Kim, 2007).

The 'very rich', obviously a minority (5% of population), earn more than US\$399 per month, which is more than ten-fold the average earnings of very poor individuals. These households own plenty of land, concrete homes with garden, motorized vehicles, enjoy easier access to credit and derive their income from remunerated formal jobs, commercial and agricultural businesses, and relatives' remittances. They own both large and small livestock, especially pigs, poultry and cattle (NSC, 2005; Warr, 2005; Andersson *et al*, 2006; Baumann, 2007; Kim, 2007).

Poverty and Cash Income

Poverty headcounts have reduced from 1992/1993 to 2002/2003 in all major geographical locations of Lao PDR (see Table 4). The Vientiane plain and the northern lowlands have seen the most dramatic poverty drops most likely due the comparatively high rate of urbanization (i.e. Vientiane, Vang Vieng and Luang Prabang) and the primary infrastructures that enable people access to labour and exchange markets.

Comparatively, for 2002/2003, the central-southern and northern highlands report the highest poverty headcounts. In fact, Andersson *et al* (2006) point out that poverty, levels of *per capita* consumption and incomes in Lao PDR can be largely explained by geographical location, household size, dependency ratios, ethnicity, level of education, and access to agricultural inputs.

Table 4. Poverty headcount and cash income in Mekong corridor and Lao PDR regions, 1992-2003.

Geographical Location	Poverty Headcount			Cash Income 2003
	1992/1993	1997/1998	2002/2003	
Mekong Corridor	55.2%	42.4%	39.8%	42%
Central – Southern Highlands	52.1%	53.9%	49.7%	39%
Vientiane Plain	34.8%	13.9%	16.6%	67%
Northern Highlands	61.1%	53.8%	45.5%	23%
Northern Lowlands	50.9%	41.0%	32.2%	38%

Source: World Bank, 2006 as quoted by Kim, 2007.

Furthermore, in 2003, cash shares in household incomes varied by location from 23 to 67 percent (Table 4). Here, households in the northern highlands earn the lowest cash income share, probably due to the disadvantaged geographical position that situates them away from markets and therefore isolated of demand-supply dynamics, whereas households in the Vientiane plain, with its strategic location, earn the highest cash income share.

The Contribution of Poultry to Household Income

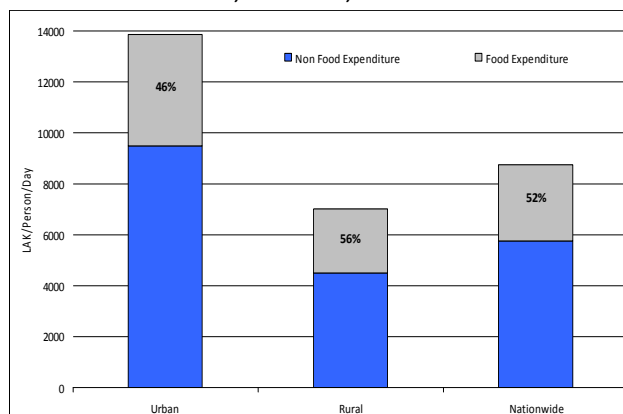
In Lao PDR, like in many other countries in Asia, poultry production is normally one of the many activities in diversified rural farming systems. Rice farming is highly predominant because it constitutes a major staple in Laotian diets. Despite all groups owning livestock at different degrees, not all of them derive the same level of income from this activity. On average, for all households, poultry income as a percentage of total monthly household income is less than 20 percent (MAF, 2004).

Although it is evident that poultry income *does* contribute to overall household income, for all socioeconomic groups this contribution is quite low, which may explain why poultry diseases are not usually a salient concern of rural or urban households. However, overall household calculations of poultry-derived income may underestimate the importance of poultry to specific groups as these calculations do not take into account to who within a household the income from poultry accrues, as it usually goes to women (Miers, 2008).

Total and Food Expenditures

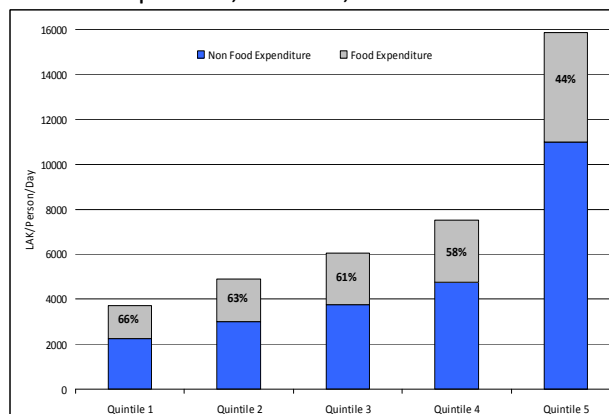
The average nationwide total expenditure is around 9,000 LAK/person/day (US\$ 1.06/person/day), with urban households having higher total and food expenditures than rural ones (Figure 10).

Figure 10. Total and food expenditures by locations, Lao PDR, 2002-2003.



Source: National Statistics Centre, LECS, 2002 – 2003.

Figure 11. Total and food expenditures by income quintiles, Lao PDR, 2002-2003.

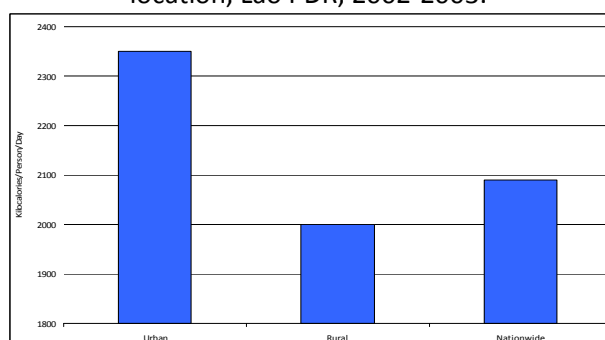


When examined by income quintiles, the amounts spent on food relative to total expenditure fall as income rises: poorest quintile households spend 66 percent of total expenditures on food compared to 44 percent in the richest quintile (Figure 11).

Nutrition and Food Consumption Patterns

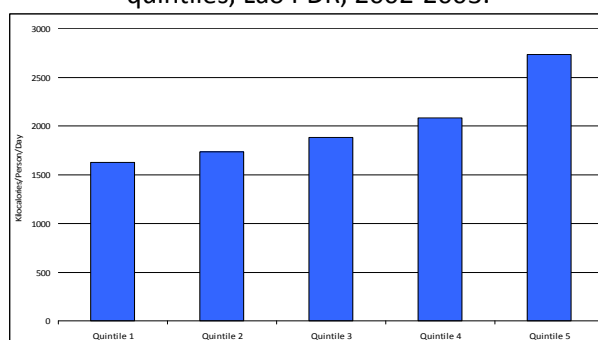
Based on household surveys, Laotians consume basic diets composed mainly of fruits, vegetables, rice, and few animal proteins. Nationwide, the average level of dietary energy consumption is 2,090 kilocalories per person per day with slight variations between urban and rural locations (Figure 12).

Figure 12. Dietary energy consumption by location, Lao PDR, 2002-2003.



Source: National Statistics Centre, LECS, 2002 – 2003.

Figure 13. Dietary energy consumption by income quintiles, Lao PDR, 2002-2003.



Furthermore, as income increases so does dietary energy consumption (Figure 13). People living in the South of Lao PDR have better access to food items than those living in the North most likely due to favorable topography, working transportation and closer access to markets (NSC, 2007).

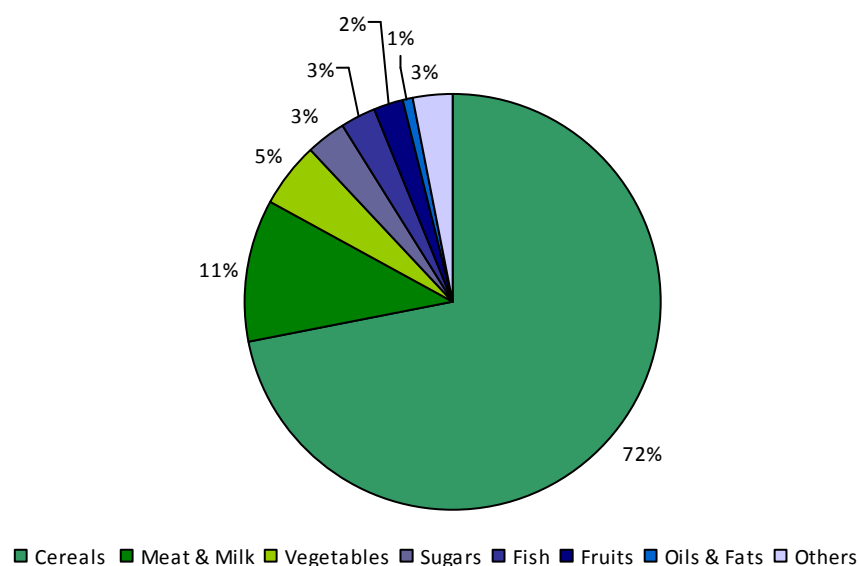
Despite dietary improvements over the past two decades, a high prevalence of stunting (48%) is seen among children under 5 years of age (stunting refers to children of short stature for their age), which is higher than the average of developing countries in the world and in southeast Asia.

The prevalence of wasting (children too thin, i.e. of low weight-for-height ratio) is 10 percent, also very high and slightly greater than the average of southeast Asian children. The prevalence of children underweight (low weight-for-age) is 44 percent, which is also significantly greater than the average of developing countries worldwide and in SE Asia (Phimmasone *et al.*, 1996).

Moreover, differences are observed in the prevalence of stunting and wasting between subgroups. For example, urban children are less likely to be stunted and wasted than rural ones, children of the lowland majority are less likely to be stunted and wasted than children of ethnic minorities, and children whose mothers had completed primary education are less likely to be stunted and wasted than children whose mothers have never been to school (Phimmasone *et al.*, 1996).

In Lao PDR, food security is synonymous with rice availability. This is not surprising considering that cereals (mostly rice) contribute 72 percent of the caloric intake of average Laotian diets. Livestock products (meats and milk, excluding fish) contribute 11 percent to caloric intake, whereas oils, fats, fruits and refined sugars contribute very little (Figure 14).

Figure 14. Dietary caloric contribution by food groups in Lao PDR, 2002 – 2003.



Source: National Statistics Centre, LECS, 2002 – 2003.

There are differences in animal protein consumption between urban and rural areas that ultimately affect nutritional profiles (Table 5). For all protein types, urban dwellers consume more than rural ones and differences are most pronounced in items such as eggs, beef and pork.

Table 5. Average animal food consumption* by source in urban and rural areas, Lao PDR, 1999.

Protein Source	Urban	Rural	Difference (%)
Fish	10	8	2 (20)
Pork	8	5	3 (38)
Poultry meat	5	4	1 (20)
Eggs	6	2	4 (67)
Buffalo meat	3	2	1 (40)
Beef	3	1	2 (60)
Total	35	22	13 (37)

Source: Bounthong Bouahom, 1999 as quoted by Wilson, 2007b; * expressed as kg/person/year.

Changes in food consumption patterns are seen in a 6 year period from 1997 to 2003 as evidenced by variations in surveyed household expenditure distributions (Table 6).

Table 6. Household expenditure distribution* by type of products, Lao PDR, 1997 – 2003.

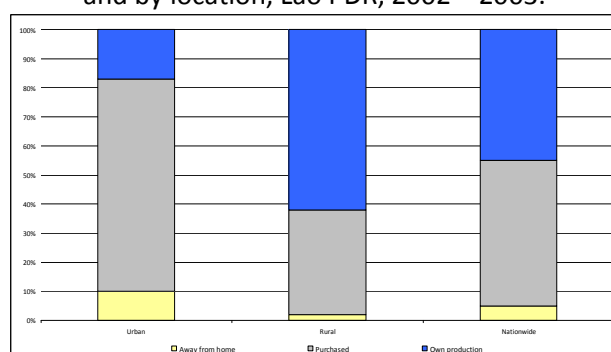
Product	1997 – 1998	2002 – 2003
Rice	46.2	35.4
Vegetable and Potatoes	9.1	8.6
Fruits	1.7	5.6
Flour and Bread	2.3	2.3
Sugar and Sweets	1.1	1.3
Oils and Fats	0.2	0.3
Meat (Totals)	16.1	22.3
<i>Poultry meat as % of all meat</i>	<i>18.5</i>	<i>24.7</i>
Milk, Cheese and Eggs	0.9	1.1
Fish	12.9	13.3
Take away food	4.1	4.8

Source: Sirikeratikul, 2006 using data from the NSC (LECS II and III); * expressed as percentages.

Variations in food consumption patterns are not limited to livestock products between urban and rural locations, but also extend to changes through time. Using NSC purchase level survey data it is evident that relative consumption expenditure on some food items does not significantly change over time (i.e. flour, milk, oils, vegetables and sweets) while relative expenditure on other food items changes drastically. For example, between 1997 and 2003 relative expenditure on fruits more than doubled whereas relative expenditure on rice dropped from 46.2 to 35.4 percent. Over the same time period, relative household expenditure on all meats increased from 16.1 to 22.3 percent, while for poultry meats this value increased from 18.5 to 24.7 percent (Table 6).

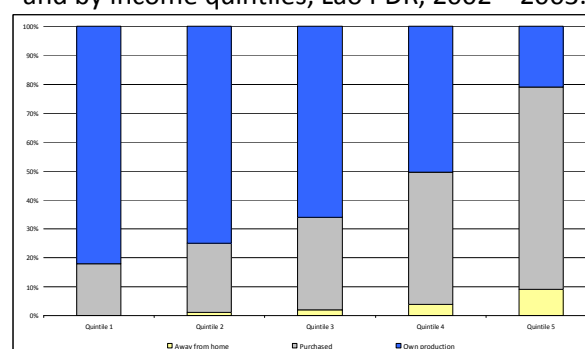
Figure 15 shows food consumption by source of origin and by location in Lao PDR.

Figure 15. Food consumption by source of origin and by location, Lao PDR, 2002 – 2003.



Source: National Statistics Centre, LECS, 2002 - 2003.

Figure 16. Food consumption by source of origin and by income quintiles, Lao PDR, 2002 – 2003.



Nationally, food purchased and food produced at home are almost of equal importance for household food supply. This national picture however masks significant differences between rural and urban populations. In rural households more than three fifths of the food consumed is produced at home with little (2%) consumed away from home. Contrastingly, urban households purchase almost three quarters of food consumed, and eat away from home more often (10%) with very little food items produced at home (<20%).

Disaggregating food consumption data by income quintiles reveals that proportions of food purchases and food consumed away from home rise as household income increases (Figure 16).

The Contribution of Poultry to Nutrition

Poultry meat consumption is an important contributor to nutrition and wellbeing. Recently updated macronutrient intake guidelines for people aged 19 to 70 recommend between 46 to 56 grams of protein per day regardless of source. It is estimated that 100 grams of fried broiler chicken meat contributes 30 g of protein and 15 g of fats. It is widely known that chicken meat is lean and high in protein and supplies significant amounts of micronutrients, such as iron, zinc and vitamins. On the other hand, eggs provide proteins and substantial amounts of several important vitamins and minerals, such as vitamins A and B12, folate, thiamin, riboflavin, phosphorus, and zinc (for more information read USDHHS/USDA, 2005).

According to institutional databases, in 1998 and 2003 Laotians consumed 30 and 40 grams of meat per person per day, respectively. Of these, 8.2 to 9.7 grams were poultry meat (FAO, 2003 and UNICEF, 2001), which would correspond to between one fifth and one third of meat consumption.

The HPAI Epidemic: Course and Institutional Response

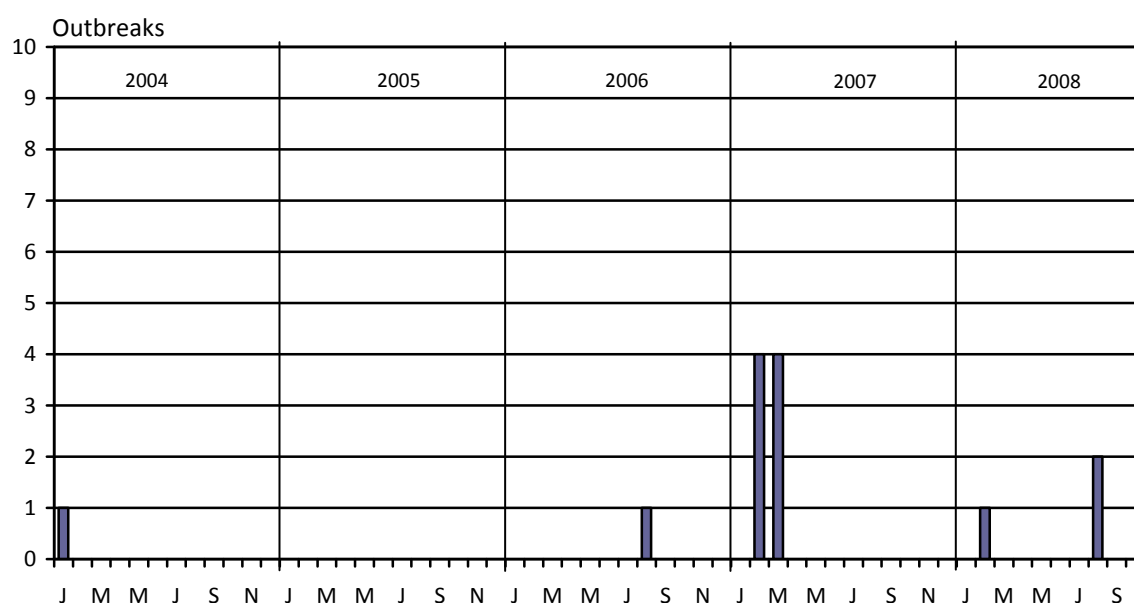
Compared to neighbouring countries, Lao PDR experienced only very small and highly localized HPAI outbreaks. The following section provides a brief account of the course of the HPAI epidemic and institutional responses mounted by Laotian animal health authorities.

Course of the HPAI Epidemic

The first report of a confirmed HPAI outbreak in Lao PDR was officially submitted to the World Organization for Animal Health on January 27, 2004 (OIE, 2004). This initial outbreak occurred in a commercial chicken layer farm in the village of Nonsavang, close to its capital city, Vientiane. The estimated date of primary infection with HPAI was January 14, 2004. The disease resurfaced once in 2006, and twice both in 2007 and 2008 (Figure 17).

Most detected HPAI outbreaks in poultry occurred in Vientiane Capital province (62%) and predominantly in commercial farms (Annex 3). Although the total number of outbreaks and birds affected is small in comparison to other countries, commercial producers lost as much as 20 percent of the national layer flock and close to 40 percent of the layer flock in Vientiane province. Commercial quail production was also badly affected, with just over a third of the national flock lost (FAO, 2008).

Figure 17. Temporal pattern of HPAI outbreaks in poultry in Lao PDR*, 2004 - 2008.



Source: World Animal Health Information Database (WAHID), OIE, 2008. * For more information see Annex 3.

The 2004 HPAI virus isolates were distinctly different genetically from later isolates. Research by Inui (2008) reveals that HA clade 2 has become the dominant clade in Lao PDR since 2006. Duck trade with Cambodia and Thailand may have reintroduced HPAI to Lao PDR (Boltz *et al*, 2006).

Eight of the thirteen outbreaks, or 62 percent, occurred in February-March of 2007. Boltz *et al* (2006) ascertain that over 156,000 birds were lost: 50,890 HPAI-related deaths and roughly 105,475 birds from government's culling efforts mostly in commercial operations in the Vientiane, Champasak and Savannakhet provinces.

National veterinary services are poorly funded, and this, coupled with Laotians' acceptance of high seasonal poultry deaths, has masked the real number and geographical extent of outbreaks that took place.

With respect to reported human cases tracked by the World Health Organization (WHO), there have only been 2 confirmed infections with HPAI in Lao PDR, both of which were fatal. These two cases occurred in February – March 2007, which corresponds to the high number of outbreaks in birds as shown above.

Table 7. Human cases of HPAI in Lao PDR, 2007.

Day	Month	Year	Location	Gender	Age
27	February	2007	Capital City, Vientiane	Female	15
16	March	2007	Saka Village, Pong Hong district, Vientiane province	Female	42

Source: World Health Organization, 2008; all confirmed cases resulted in death.

Both human cases were females living in Vientiane province, one aged 15 and the other one 42. It was reported that disease contraction was most probably a result of direct contact with sick birds while tendering care or during preparation of food (*for more information see Annex 4*). Despite nationwide awareness-raising campaigns, HPAI is not perceived as a risky disease for birds and humans calling for drastic behavioural changes, a view which is particularly predominant in rural areas (Barennes *et al*, 2007).

Animal Health Services and Institutional Response

The Ministry of Agriculture and Forestry of Lao PDR (MAF), is responsible for all management, oversight and policy matters related to crops, natural resources (renewable and non-renewable), livestock, fisheries, agricultural services and forest development. It is composed of eight collaboratively interrelated dependencies: Department of livestock and fisheries (DLF), Department of agriculture (DOA), Department of forestry (DOF), Department of inspection (DOIN), Department of irrigation (DOI), Department of organization and personnel (DOAP), Department of planning (DOP) and Permanent secretary office (MAF, 2008).

The Department of livestock and fisheries within MAF is tasked with providing veterinary service assistance, to oversee appropriate development of the livestock sector, and for promoting sustainable animal production of different scales throughout the country. The handling of livestock diseases, such as HPAI, lies within the remit of responsibilities of this department (DLF, 2008).

Control measures

In Lao PDR after confirmation of HPAI outbreak, MAF, DLF, and the National Animal Health Centre (NAHC) met, discussed and agreed on a series of emergency control measures that included poultry movement restrictions, poultry import bans from Thailand, enhanced border trade inspections, media campaigns to raise public awareness, protection and surveillance zones around outbreaks, and a stamping-out (culling) program for all birds within 3 kilometres of identified outbreak sites. Originally, compensation plans for culled birds had been considered, but these plans were rapidly abandoned due to their heavy financial commitment (Nicely, 2005).

Additionally, an emergency disease control task force was established to coordinate the implementation of measures, rehabilitate laboratory facilities for confirmatory testing, and organize training of animal health officials in disease detection, biosecurity enhancements, disinfection, surveillance, culling, and disposal techniques.

Moreover, the control measures applied in the latest HPAI outbreak (August 2008) were: stamping out, movement control inside the country, screening, and disinfection of infected premises. Vaccination is prohibited (OIE-WAHID, 2008).

Poor governance, institutional shortcomings and weak law enforcement have been reported to limit effective disease risk management in highly poultry populated areas. For example, the five border checkpoints with Thailand were all instructed to be vigilant to incoming poultry imports, but effective policing of border trade along the Mekong River proved to be (and still remains) extremely difficult to conduct. Furthermore, despite bans, some farms in Champasak province were not timid to announce they had restocked with day-old chicks from Thailand (Nicely, 2005).

In response, researchers have proposed the progressive development of practical risk-based, low-cost strategies for the successful management of animal movement in an attempt to halt the spread of transboundary animal diseases (Madin *et al*, 2008).

It is worth noting that Lao PDR faces a monumentally challenging border oversight task, as it is a landlocked country that shares a 505 km border with China to the north, 435 km of border with Cambodia to the south, 2,069 km of border with Viet Nam to the east, 1,835 km of border with Thailand to the west, and a 236 km border with Myanmar to the northwest (Sirikeratikul, 2006).

Grassroots approaches to disease surveillance

In the long run, as detrimental and regrettable new HPAI outbreak reports might seem, this could also be interpreted as improved disease awareness by farmers coupled with better sample collection procedures by veterinary agents and enhanced confirmatory analysis by laboratories, compared to previous years. But despite improvements in disease detection and reporting, it is clear that the main constraints for efficient disease prevention, early detection, and effective control are the limited capacity and under-funding of the veterinary services. In response to these deficiencies, the government, aided by international organizations, created village surveillance networks by training village veterinary workers (VW) that deliver reliable grassroots disease information. These VW are linked to district and provincial veterinary services, as well as the central veterinary epidemiological and diagnostic capacity (Mondry, 2008).

In addition to the abovementioned initiative, a disease awareness and training program was launched nationwide, with the intention to inform all parties involved about HPAI. Specifically, provincial and district livestock officials received training related to avian influenza epidemiology, active and passive surveillance strategies, immediate outbreak control measures as well as disinfection and follow-ups after outbreaks. As a result, significant increases in reporting of high poultry mortality (triggered by >20 percent mortality rate) were noticed immediately after initiation of an incentive-based passive village surveillance network (Mondry, 2008).

Khounsy and Conlan (2008) studied the epidemiology and ecology of classical swine fever in rural areas of Lao PDR and indirectly imply that grassroots approaches to disease surveillance of avian diseases could very well work for swine diseases. This is an idea that warrants further examination.

Social and Economic Impact of HPAI and Control Measures

An accurate 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

The most immediately deleterious impact of HPAI to livestock producers is the loss of their productive assets, which can be caused either by the disease itself or by government-mandated stamping out measures. Between 2004 and 2008 a total of 156,365 birds have died / been culled resulting in a direct monetary loss of roughly US\$235,000 (assuming an average value of US\$1.50 per bird). The loss of income for an average broiler farm of five hundred birds is roughly US\$1,100 per month resulting in many of the farmers unable to repay loans, and having difficulties in accessing new credit to finance animal stocks, feed and medications (MAF, 2004).

Because of the concentration of outbreaks in commercial enterprises, the economic impacts were most severely felt by the commercial broiler and layer operations and some quail farms, mostly due to uncompensated culling coupled with market inactivity. Restocking delays by commercial farmers varied between two to eight months due to post-outbreak anxiety and market uncertainty.

Traders, intermediaries, and market sellers experienced income reductions ranging from 20 to 40 percent during the four weeks following an outbreak. Semi-commercial poultry producers that were affected by stamping out measures had to dismiss workers to cope with asset losses and foregone income, and this, in turn, had societal effects that trickle down slowly into the economy as reduced expenditures during labour downtime (MAF, 2004).

Livelihood impacts were also visible in rural areas, where poor female-headed families experienced particular difficulties raising pocket cash during the first outbreak, but, luckily, were able to sell poultry later on. A government report estimates that in these female-headed households poultry related income dropped from 63 to 43 percent of total income in affected locations (MAF, 2004). For these women, temporarily adjusting expenditures to reduced income was the most feasible coping strategy.

Immediate Direct Impacts through Consumer / Market Reactions

Disease impacts arise through market reactions, which can be particularly severe on the demand-side in the case of diseases that are associated with a public health risks. Initially, Laotian consumers were immediately reluctant to buy and consume poultry meats and eggs due to fears of contracting disease, leading to reduced demand for poultry products and increased demand for alternative meats (especially fish and pork). As a result prices for poultry meats and eggs decreased mildly (5 to 10%) and conversely, sales and prices for alternative meats increased by 10 to 20 percent (MAF, 2004).

In stark contrast to Thailand and Viet Nam, supply drops due to fierce stamping out efforts in the commercial sector around Vientiane did not drastically affect local market prices or availability of poultry products because smallholder production outputs were able to satisfy ongoing demand.

Short-term Indirect Flow-on Impacts

The indirect impacts that HPAI and the consequential animal losses have on related industries is much more complicated to quantify because these shock waves propagate upstream and downstream through related supply mazes and distribution networks. However, there is evidence that commercial producers were more severely affected by market uncertainty and production downtime. Also, poultry farmers were keeping a temporary low production profile that translates into lower amounts of feeds purchased, which in turn affected feedstuff purveyors and grain sellers.

One potentially overlooked short-term impact of HPAI is the lower nutritional profiles of Champasak, Savannakhet, and Luang Prabang villagers due to reduced consumption of eggs and meats during and after outbreaks. Not only were poultry products avoided, but the purchase of alternative meats may not have replaced foregone intakes of poultry products because of higher prices for pigs, fish and beef.

Overall, the production sector was impacted by government-mandated poultry input import bans from Thailand and Viet Nam that caused prices of day-old chicks to rise from 3,000 LAK (US\$0.35) to 5,000 LAK (US\$0.59), while the price for ducklings remained at 4,000 LAK (US\$0.47). This price increase prompted many smallholding poultry farmers to switch new stock purchases from chickens to ducks or to delay restocking altogether (MAF, 2004).

Medium- to longer-term Impacts and Adjustments

In response to the crisis some producers switched completely away from poultry into fish farming, cattle, and hog production. However, it is not really known if producers switched to these activities *de novo* in response to HPAI outbreaks or if they were already engaging in suitable mixed farming systems as a risk diversification strategy. For those farmers (men) with no financial means to reinvest in poultry keeping, the most common alternative livelihood strategy was migration to cities for jobs.

Unlike Viet Nam, the government of Lao PDR has not embraced severe measures, such as 'centrally planned' poultry sector restructuring under a timeline in response to HPAI outbreaks. This may be due to the fact that the commercial poultry sector in Lao PDR is small, localized, loosely organized and without any strong lobbying power that could attain any significant political buy-in.

Conclusions

Poultry production (mainly of chickens and ducks) in Lao PDR is dominated by smallholder backyard systems with a small private sector applying semi-intensive and intense production practices grouped around urban consumption hubs, but mainly concentrated around the capital Vientiane. Domestic demand for animal protein is increasing due to population growth, rising overall incomes, and urbanization. This demand growth provides incentives for livestock producers to engage in further poultry sector development as well as for importation of poultry products from neighbouring low-cost producers. The Government of Lao PDR should play a significant role in supporting livestock sector development by enhancing institutional capacities and enacting progressive legislation that not only provide appropriate working frameworks for regulation, oversight and taxation but also promote private sector initiatives to develop markets and raise bio-security and food safety.

Similar to the situation in Cambodia, Lao's HPAI epidemic waves were mild compared to the situation experienced by its neighbours Thailand and Viet Nam and only consisted of thirteen registered outbreaks, most of which occurred near the capital city. Most recorded HPAI outbreaks occurred between February and March 2007, but only caused infection and death of 10, 097 birds. However, it was in this period that two persons were infected and died.

Government-mandated control measures included stamping out, movement control inside the country, screening, and disinfection of infected premises; however, vaccination was (and still is) prohibited. Altogether, more than 156,000 birds died due to HPAI or culling measures with commercial producers, particularly those keeping layers, being more seriously affected than rural backyard producers.

The socio-economic threat of HPAI for Lao PDR is not so much through the immediate impacts of the outbreaks so far but the opportunity cost of poultry sector development. As in other Mekong countries, local varieties command a price premium vis-à-vis commercially produced broilers. Given the demand growth for poultry products and the price premium for traditional varieties, it would seem that there is scope in Lao PDR to promote both commercial and traditional poultry production through appropriate policy incentives.

As a country dependent on imports of inputs, day-old-chicks and poultry products from neighbouring countries that still have HPAI; one policy issue that needs to be addressed is how to prevent virus reintroduction without or with only minimal negative impact on the development of domestic poultry production.

It seems that incentive-based passive surveillance systems using trained village veterinary workers reporting to animal health officials, combined with rapid disease investigation could result in a pragmatically low-cost and sustainable approach to monitor HPAI nationally considering the limitations in human and financial resources. This, in combination with a market-driven, self-financed, certification programme for HPAI-freedom could foster considerable quality improvement among small-scale producers, middlemen and retailers, while at the same time sparing significant fiscal outlays.

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ANNEX 1. Demographics, Land and Socio-economic Indices, 2005

Human population	5.5 million
Population density	24.0 person/sq km
Annual population growth rate (1990-2000)	2.4%
Population in agriculture	4.2 million
as proportion of total population	76.36%
Total land area	230,800 sq km
Agricultural land	18,790 sq km
as proportion of total land	8.14%
Land under pasture	8,780 sq km
as proportion of total land	3.80%
Agricultural land per 100 people	34 ha
Agricultural land per 100 people in agriculture	45 ha
GDP <small>(constant at 1995 US\$)</small>	2,640 million
GDP annual growth rate (1990-2000)	6.3%
GDP per capita/year	US\$477
GDP per capita annual growth rate (1990-2000)	3.7%
Agriculture, GDP	not available
as proportion of total GDP	not available
Livestock, GDP	not available
as proportion of total GDP	not available
Poverty incidence	
Total	38.6%
Urban	26.9%
Rural	41.0%

Source: FAO – AGAL, Livestock Sector Briefs, Lao PDR – March, 2005.

ANNEX 2. Livestock Population* (except poultry) Lao PDR, 1996 - 2004

Species	1996	1998	2000	2002	2004
Buffalo	1,211.7	1,092.7	1,028.0	1,089.4	1,124.5
Cattle	1,186.0	1,126.6	1,060.0	1,220.5	1,281.2
Goat	159.0	122.0	115.0	127.5	140.6
Pigs	1,772.0	1,432.0	1,347.0	1,608.1	1,727.3

Source: Wilson, 2007b using statistics from MAF and NSC. * expressed as thousands of heads.

ANNEX 3. HPAI Outbreaks in Poultry in Lao PDR, 2004 – 2008

Year	Month	Location		Bird type(s)	No. of birds susceptible
		Province / Town	District / Village		
2004	Jan	Vientiane Capital	Nonsavang	Laying hens	3,000
2006	Aug	Vientiane Capital	Dong Bang	Chickens	6,000
2007	Feb	Vientiane Capital	Sisattanak	Layer Ducks	1,380
2007	Feb	Vientiane Capital	Sisattanak	Chickens / Ducks / Geese	54
2007	Feb	Vientiane Capital	Sisattanak	Laying Ducks	600
2007	Feb	Vientiane Capital	Sisattanak	Chickens / Ducks / Pigeons	62
2007	Mar	Champasak	Bachengchleunsuk	Chickens / Ducks	3,201
2007	Mar	Savannakhet	Various	Chickens / Ducks	35,000
2007	Mar	Vientiane Capital	Phonhong	Ducks	700
2007	Mar	Vientiane Capital	Thoulakhom	Ducks	500
2008	Feb	Luangnamtha	Namma and Long	Native Village Chickens	1,317
2008	Sept	Oudomxay	Nalae village	Native Village Ducklings	1,170
2008	Sept	Luang Prabang	Fa village	Native Village Ducklings	5,422

Source: World Animal Health Information Database (WAHID), OIE, 2008.

ANNEX 4. Details of HPAI Cases in Humans in Lao PDR, 2007

27 February 2007 - The Ministry of Health in Lao People's Democratic Republic has today reported the first human case of infection with the H5N1 avian influenza virus.

The 15-year-old female was from Vientiane, where she developed influenza-like symptoms on 10 February and was hospitalized in Vientiane with fever and respiratory symptoms on 15 February. She sought medical care in neighbouring Thailand on 17 February and is currently in Nongkhai public hospital where she remains in stable condition. Samples taken by Lao epidemiologists and Thai clinicians were tested by the National Institute of Health in Thailand and were positive for H5N1 infection. The Lao Government is also providing samples to a WHO collaborating centre for examination.

On February 24 and 25, a team from the Thai and Lao ministries of health and WHO officials investigated the situation in the girl's village and those districts where poultry deaths had occurred earlier. Close contacts of the girl have been identified and are being monitored daily. The adults were provided prophylaxis with Oseltamivir and to date; all of these people remain healthy.

8 March 2007 - The Ministry of Health in Lao People's Democratic Republic has confirmed the country's first death from H5N1 avian influenza.

The 15-year-old female from Vientiane, whose infection was announced 27 February, died on 7 March after being hospitalized in neighbouring Thailand.

16 March 2007 - The Ministry of Health in Lao People's Democratic Republic has reported a second human case of infection with the H5N1 avian influenza virus. The case was fatal.

Initial testing was conducted by the National Centre for Laboratory and Epidemiology in Laos. In line with WHO policy, samples were sent to a WHO collaborating laboratory in Tokyo for diagnostic verification and further analysis. The collaborating centre has now confirmed H5N1 infection.

The 42-year-old female was from Saka village, Pong Hong district in Vientiane province. She developed fever 26 February and was hospitalized in Vientiane Provincial hospital on 28 February and then transferred to Sethathirat hospital on 1 March. She died on 4 March. Tests taken during an investigation to determine the source of exposure have found a duck positive for H5 in the woman's household. Close family and hospital contacts are being monitored and to date, none has shown signs of infection.

Source: WHO, Epidemic and Pandemic Alert and Response (EPR), Avian Influenza Disease Outbreak News, 2007.

ANNEX 5. Lao PDR Poultry Population (thousands) by Province, 1976-2006

No.	Province	1976	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01	Vientiane Capital	0	0	353	355	1,170	1,257	1,222	1,309	1,181	1,340	1,674	1,938	3,700	1,899	263	950
02	Phongsaly	161	94	184	149	292	299	305	286	286	254	310	295	380	365	412	540
03	Luangnamtha	287	440	266	160	214	199	223	212	223	229	257	264	374	288	349	336
04	Oudomxay	560	355	276	894	537	699	561	404	560	573	503	644	715	1,683	734	765
05	Bokeo	0	0	59	251	304	285	318	411	307	315	371	280	469	420	425	370
06	Luangprabang	240	193	398	451	964	123	1,007	843	893	914	1,004	836	965	1,102	1,345	981
07	Houaphanh	361	575	862	689	972	803	911	621	783	801	504	1,955	1,726	1,501	1,907	2,287
08	Xayabury	99	392	600	612	1,030	1,219	1,075	1,207	1,165	1,192	1,457	1,555	1,627	1,707	1,999	1,666
09	Xiengkhuang	182	131	314	371	519	485	542	518	610	692	483	489	560	504	793	968
10	Vientiane	568	805	501	616	825	881	861	1,005	937	1,064	1,054	1,054	1,328	1,476	1,743	1,584
11	Borikhamxay	0	0	147	342	250	357	261	438	473	536	606	532	628	771	688	676
12	Khammouane	255	244	504	303	405	502	423	456	355	403	720	612	643	930	1,117	791
13	Savannakhet	435	633	769	484	806	996	841	1,444	1,248	1,417	2,069	2,169	2,031	1,998	2,289	2,034
14	Saravane	181	149	117	573	732	849	765	1,058	554	567	160	144	1,152	1,628	2,675	2,367
15	Sekong	0	0	79	97	128	100	134	69	128	131	1,911	133	211	116	133	554
16	Champasack	486	533	755	1,520	2,038	2,201	2,127	1,481	1,223	1,251	657	2,004	2,412	2,263	2,410	3,570
17	Attapeu	261	75	286	178	255	130	267	220	168	172	231	271	360	250	360	365
18	Xaysomboon SR	0	0	0	0	0	0	107	131	160	181	94	100	194	579	160	0
	Totals	4,076	4,621	6,470	8,044	11,438	11,385	11,947	12,111	11,252	12,028	14,065	15,275	19,475	19,481	19,802	20,804

Source: Lao PDR National Statistics Centre using data from the Ministry of Agriculture and Forestry, 2008; <http://www.nsc.gov.la/Statistics/Selected%20Statistics/Agriculture/Livestock.htm>