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HPAI PRO-POOR HPAI RISK REDUCTION
HIGHLY PATHOGENIC AVIAN INFLUENZA

Poultry, HPAI and Livelihoods in Cambodia – A Review

S. Burgos, J. Hinrichs, J. Otte, D. Pfeiffer, D. Roland-Holst, K. Schwabenbauer and O. Thieme

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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.

Authors

Sigfrido Burgos, Jan Hinrichs, Joachim Otte, Karin Schwabenbauer, and Olaf Thieme work at the Food and Agriculture Organization (FAO), Dirk Pfeiffer works at the Royal Veterinary College (RVC) and David Roland-Holst works at the University of California – Berkeley (UCB).

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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, Cambodia.

More information

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

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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 Cambodia; 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

Currently reaching US$40 billion GDP, Cambodia has stabilised its economy and reduced poverty levels but still suffers from a legacy of corruption and internal strifes. Eighty-one percent of the population of 14 million is rural; with agriculture accounting for two fifths of GDP and constituting the main domestic activity of rural households. The livestock sector contributes 15 percent to agricultural GDP and as sub-sector ranks among the highest for growth potential and development. Cambodia's membership to the World Trade Organization in 2004 has helped increase trade between free market economies worldwide, especially exports of logs, garments, rice, sawn timber, rubber, shoes and fish products to the U.S., Eurozone and Japan.

Cambodia's Poultry Industry

In Cambodia, poultry are an integral part of rural peoples' livelihoods. With an increasing population of 15 million birds, poultry is a livestock asset that is easy to raise and maintain. Three main chicken and duck production systems co-exist: (i) traditional, small-scale, extensive backyard/garden poultry production, (ii) semi-intensive, small to medium scale, market-oriented, commercial chicken/duck production, and (iii) intensive, large scale, industrially-integrated chicken/duck production. Poultry production is exclusively a private sector affair with minimal public intervention. Commercial farms serve as major suppliers of poultry products to major cities such as Phnom Penh, Battambang, and Siem Reap. Most inputs are purveyed in China, Thailand and Viet Nam. Similar to Viet Nam, live bird traders are key agents in poultry marketing. Village animal health agents play a critical role in providing animal health and technical advice to farmers; with civil society organizations acting as financing entities in rural settings.

Poultry and Livelihoods

Poultry production is one of the many activities in diversified rural farming systems and more than half of all Cambodian households keep poultry. Revenues from poultry only represent very small proportion of total household revenues, but women accrue most of this income, which allows them to cover household and education expenses. Despite rising *per capita* incomes and dietary improvements, malnutrition levels remain high. On average, livestock products contribute one tenth of caloric intake, and from this, poultry meat accounts for around one quarter. Typical rural households consume about 154 grams of poultry meat and 4 to 9 eggs per week. Local birds breeds are the most demanded, especially during festivities and celebrations.

The HPAI Epidemic: Course and Institutional Response

From 2004 to 2008, Cambodia reported 20 HPAI outbreaks comprising a little over 21,000 birds. Thirteen of these outbreaks occurred in March - April of successive years, while six occurred in July, August and September. These periods coincide with releases of ducklings into rice fields in South Cambodia's and Viet Nam's Mekong region. The temporal occurrence of the seven recorded HPAI infections in humans coincides with periods of HPAI outbreaks in poultry. After HPAI outbreaks started, the government imposed, through so-called PRAKAS issued on a case by case basis by the Minister of Agriculture, poultry movement restrictions, culling of infected flocks without compensation, 3-km protection zones and 10-km surveillance zones around outbreaks, and temporary suspension of sales and purchases of birds. However, currently there is no law describing

the veterinary authority and its role, responsibilities and powers. In the area of animal disease control, existing policies and operational plans are supported by a range of legal instruments but their links with higher levels of law are still weak. Some elements that are important for effective disease control are not reflected in existing legal instruments, such as requirements for owners of livestock to report notifiable diseases and the power to control movements in an area where disease is suspected. Law enforcement in general is weak allowing for disease persistence. Current government policies encourage poultry raisers to move away from free-range systems and to implement bio-security measures which many producers however cannot or will not adopt.

Social and Economic Impact of HPAI and Control Measures

Nationally, about 30,000 birds were lost to HPAI, and the medium- and large-scale duck and industrial-integrated layer and broiler farms bore most of the impact. Commercial producers were more severely affected by market uncertainty and production downtime than by the disease itself. Culling caused particular hardships to smallholder farmers that had borrowed from micro-finance and banking institutions. The loss of animal assets by commercial players prompted owners to lay off workers and to temporarily reduce salaries to cope with the crisis. Fear of HPAI contraction prompted consumers to shift to other meats, fruits, vegetables and nuts, which made these and other food-basket items more expensive.

Reductions in bird stocks and unwillingness to sell poultry due to depressed market prices affected poultry trading in general, but was particularly felt by middlemen and traders who saw declining transactions and sales in villages and city markets. Many traditional poultry keepers coped easily with the market shock because scavenging chickens do not require large amounts of purchased feed, whereas keeping commercial chickens for longer than normal does involve additional costs. For affected farmers and traders heavily invested in the poultry business, a common alternative livelihood strategy was migration to cities in search for jobs.

During the HPAI outbreaks, the outcomes in affected communities were different from those in unaffected communities, because some flocks were culled without compensation and the remaining poultry could not be moved or sold outside the community. This situation did not remain in force for long, however, and farmers restarted raising and trading poultry and poultry products within a few months. People in both types of community were initially afraid of the impact of HPAI on human health, but after a few months the situation had returned to normal for them.

Conclusions

Cambodia's HPAI epidemic was mild compared to the ones experienced by Thailand and Viet Nam, with the fledgling commercial sector being most severely affected. In Cambodia, the socio-economic threat of HPAI is thus not so much related to the immediate impacts of outbreaks but to the opportunity costs of sector development. The industrial poultry sector is still small in comparison to the traditional backyard poultry sector as far as contribution to total national poultry production is concerned. However, demand for animal protein is rising rapidly leading to shortfalls in domestic supplies which the traditional sector cannot easily fill. For poultry, this is particularly relevant because the commercial sector is highly dependent on imports of inputs from neighbouring countries that still experience HPAI outbreaks.

The ultimate responsibility of ensuring national animal and public health rests with government actions; however, in the case of Cambodia, implementation requires dynamic private sector participation. The demand for safe poultry products and preference for traditional local varieties could pave the way to promote both commercial and traditional poultry production through appropriate livestock policies and market-based incentives. Effective intervention programs must however include options for resource-poor households to keep poultry and/or provide alternative livelihood options.

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, Cambodia being one of these. The document is divided into six sections. The first section deals with Cambodia'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 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 Cambodia's poultry sector to successfully develop in the aftermath of HPAI.

Macroeconomic Overview

Cambodia's current economic progress still suffers from a legacy of rampant corruption, decades of war and internal strife. Economic growth is estimated to have dipped to 8 percent in 2007. Although still impressive, this marks the end of Cambodia's cycle of double-digit growth rates. Regional GDP per capita is lower when compared to neighbouring countries ($2,857 vs $3,005 in Viet Nam; Table 1). Overall economic policy performance is set to remain positive, with the budget deficit remaining under control. The government's success in stabilising the economy and reducing poverty levels has earned it solid IMF support, which has regularly commended Cambodian progressive policymaking.

Table 1. *Per capita* GDP in selected southeast Asian countries, 2007.

Description	Thailand	Viet Nam	Cambodia
Per capita GDP (in US$)	8,000	3,005	2,857

Source: The Economist Intelligence Unit, 2008 for Thailand and Vietnam; Average value for Cambodia from Box 1 below.

The government of Cambodia, a constitutional monarchy, implemented during 1995 a series of economic stabilization policies under exacting circumstances, and the overall macroeconomic performance derived therefrom has been positive (Table 2). For example, support to the agricultural sector has improved production of some commodities, especially that of rice. Growth has been strong in construction and service sectors too. Inflation rates dropped and remained relatively under control until 2006 (at approximately 5 percent); however lately, consumer price inflation has accelerated, largely owing to the general upward trend in food prices (in December 2007 food prices were up by 19.8 percent on a year by year basis), thereby putting pressure on low-income households. Local retail fuel prices also remain on an upward trend, underpinned by increases in global crude oil prices, which could ultimately halt Cambodia's per capita GDP growth.

Table 2. GDP, human population and *per capita* GDP, 2000 to 2006.

Description	2000	2001	2002	2003	2004	2005	2006
GDP-PPP***	16.1	18.7	19.7	25.1	27.0	34.1	36.8
Population**	12.2	12.5	12.8	13.1	13.4	13.6	13.9
Per capita GDP*	1,319	1,496	1,539	1,916	2,015	2,507	2,647

Source: CIA World Factbook - 2007; *** purchasing power parity in billion US$; ** in millions; * in US$.

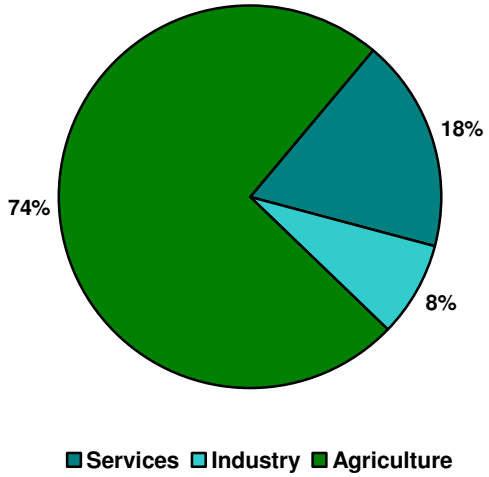
International and neighbour country financing, coupled with moderate economic progress, has facilitated increments in imports of products and services. Exports, representing close to 30 percent of GDP, have also increased, but not at the same rate as imports, resulting in a negative trade balance (negative US$217 million for 2000). The current account balance and overall fiscal deficit are now lower than originally targeted, but still on the negative side. The government maintains a degree of fiscal discipline, but owing to the fact that revenue is forecasted to remain low as a percentage of GDP, Cambodia will record an annual budget deficit of around 2 percent of GDP for 2008 - 2009.

Economic progress in Cambodia slowed down dramatically during 1997 - 1998 due to civil violence, workers' riots, student up-rise, regional economic crisis, droughts, suspension of foreign investments, and political instability. The following year, 1999, was a landmark for Cambodians: it represented the first full year of peace after 30 continuous years of conflict. In the following years important changes took place, such as sound economic reforms, support of free trade and implementation of better lending practices that resulted in sustained growth rates of 4 to 7 percent across the board.

Eighty-one percent of the population of 14 million is still classified as rural and agricultural activities are at the heart of economic development. Agriculture accounts for 39 percent of GDP and constitutes the main domestic activity of rural households. The service sector, contributing 38 percent to GDP in 2006, is mainly composed of general trading activities, communications, public utilities, air and land transport, hotels, restaurants and other tourism-related services. In 2006, industry accounted for 23 percent of GDP. Informal and small-scale manufacturing is multipurpose and varied, with small outputs per unit of production. Formal, big-scale, industrial manufacturing is more structured and supported, and has had a remarkable run from 2002 to 2007. The garment sector accounts for a large share of Cambodia's export revenue. Manufacturing increasingly dominates the industrial sector, accounting for 75 percent of industrial value-added and nearly 15 percent of GDP in 2000. Moreover, export growth in 2008 - 2009 is still expected to be high, but is likely to be curtailed by greater competitive pressures from countries like China, India, and Viet Nam.

Most of the economically-active population (7.0 million or 50 percent of the total population) lacks adequate health care, proper education, social welfare and productive skills. This occurs most profoundly in the poverty-ridden rural countryside, which suffers from an almost total lack of basic infrastructure. This is probably one of the reasons that the labour force of Cambodia is overwhelmingly agricultural-oriented (Figure 1).

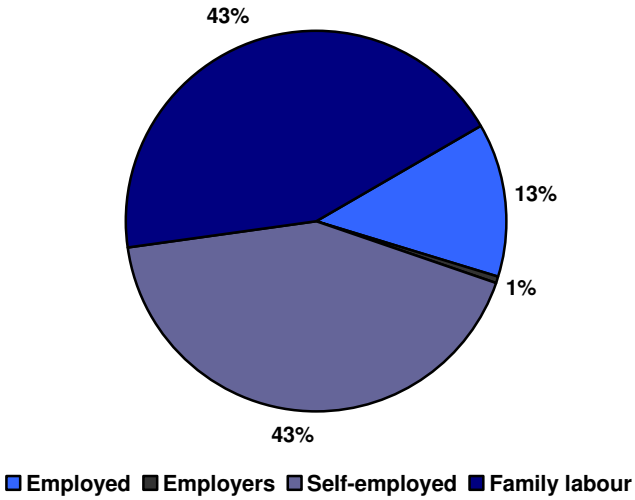
Figure 1. Cambodia's labour force by economic sectors, 2004.



Source: Cambodia Inter-Censal Population Survey (CIPS), 2004.

Statistics on Cambodia's general employment status reflect the heavy reliance on family labour. Only close to 13 percent of the workforce is paid, and only 0.5 percent are employers, while the remainder is divided approximately equally between self-employed workers and unpaid family labour (Figure 2).

Figure 2. General employment status in Cambodia, 2004.



Source: Cambodia Inter-Censal Population Survey (CIPS), 2004.

In urban areas, close to 30 percent of the labour force are paid employees and 27 percent are unpaid family workers. Contrastingly, in rural areas only 9 percent of workers are paid employees and 47 percent are unpaid family workers.

In 2004, national unemployment rates stood at 7.2 percent, being more pronounced in rural areas and less in urban settings for literate job seekers. In 2006, the Cambodia Development Resource Institute (CDRI) found that many people in rural areas have difficulties in finding jobs and some

remain jobless for months, therefore spending more time in agricultural-related activities and informal petty-trade.

Over 25 percent of the population is currently between 10 and 19 years of age, and labour force participation rates for this group are expected to increase rapidly during the next years. Because past economic growth has not been sufficient to absorb new entrants to the labour force, there are however indications that un(der)-employment is increasing.

Box 1. Country Facts

Official Name	Kingdom of Cambodia
Government	Constitutional Monarchy
Capital City	Phnom Penh
Area	181,035 sq km
Population	14 million
Population Density	78 per sq km
Urban Population	19%
Rural Population	81%
Religion	Theravada Buddhism
Language (official)	Khmer
Currency	Cambodian Riel (KHR)
Life Expectancy	61.3 Years
Inflation Rate	5.0%

General Economic Indices

GDP-2006 [PPP]	US$44.7Bn (IMF); US$36.5Bn (WB); US$38.9Bn (CIA); US$40.0Bn (Average)
GDP-2006 *per capita*	US$3,192 (IMF); $2,608 (WB); US$2,778 (CIA); US$2,857 (Average)
Agriculture-GDP	39%
Industry-GDP	23%
Service-GDP	38%
HDI [2007]	0.598 (medium)

Sources: The World Bank, CIA fact sheets, International Monetary Fund, wikipedia.

Agriculture

As one of the three main components of GDP, agriculture is paramount to the health, promotion and development of the Cambodian economy. Agriculture alone accounted for almost 40 percent of GDP in 2006. According to the Ministry of Agriculture, Forestry and Fisheries (MAFF), the livestock sub-sector, within agriculture, ranks among the highest with respect to its potential for growth, followed by fisheries, and has been set as a priority for future agricultural funding and development.

In 2007 there were 2.4 million males and 2.8 million females working in the agriculture sector and the sector absorbs anywhere between 150,000 to 250,000 individuals joining the labour force annually. Despite its relevance, under-funded state agricultural institutions provide little assistance to farmers, and this is manifested through a debilitating combination of weak state capacity and poor governance. To promote sustainable agro-economic growth, the Cambodian government is increasing expenditure in social and economic development by enhancing fiscal revenues, attracting more foreign financing for public investments, and reducing expenditures on defence and security.

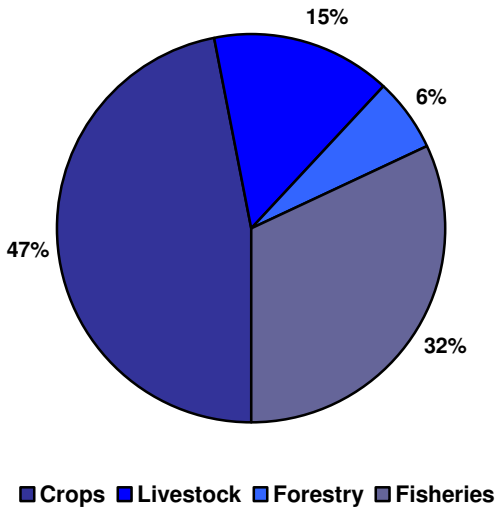
Corruption, which is widespread in the public sector, has also spilled into private forums, and is often embedded in non-regulated agricultural transactions. For example, corruption allegations are so flagrantly conspicuous that the US congress prohibited American funds to be channelled through the Cambodian government, and mandated that all funds for programme implementation flow through non-Cambodian NGOs. There are more than 400 NGO's currently active in the country.

Noteworthy is Cambodia's membership to the World Trade Organization in 2004. It was the first least developed country to join after complying with WTO's demanding list of requirements. This event has helped the country to join the trade between free market economies worldwide, and has boosted its garments and shoe manufacturing industry. Exports of logs, rice, sawn timber, rubber and fish products are rising, with export to the US, the Eurozone and Japan increasing. With China and Malaysia positive trade balances exist since 2005.

Livestock

In 2004, the livestock sector contributed 15 percent to agricultural GDP (Figure 3). Opposed to what is seen in other Southeast Asian countries, in Cambodia, bovines are more important than swine, because buffaloes and oxen are kept for a variety of laborious fieldwork activities. Additionally, live cattle are informally, and sometimes illegally, exported to Viet Nam and Thailand, although there is no quantifiable value for these clandestine sales. Pork and poultry, on the other hand, are ubiquitous throughout the country. They are slaughtered predominantly for domestic consumption and act as a source of supplementary income for rural households.

Figure 3. Composition of Cambodia's agricultural GDP, 2004.

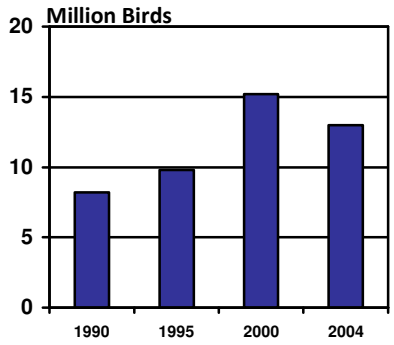


Source: Cambodia Statistical Yearbook, National Institute of Statistics, 2005.

Cambodia's Poultry Industry

Poultry, comprising mainly chickens (81.3%) and ducks (18.6%) are an integral part of rural peoples' livelihoods in Cambodia (DAHP, 2003). Because poultry are a livestock asset that is easy to raise and maintain, numbers of chicken and ducks have increased steadily since the nineties. From 1990 to 2000, the number of chicken and ducks increased at an annual rate of more than six percent to nearly double over the period (Figure 4). For 2004, the National Institute of Statistics (2005a) reports an estimate of around 13 million birds, a drop of three million from 2003, possibly as a result of HPAI.

Figure 4. Cambodia's poultry population, 1990-2005.



Source: Cambodia Statistical Yearbook, National Institute of Statistics, 2005.

Other species such as geese, pigeons and quails are mainly kept in rural, non-commercial backyard farms as alternative sources of food and income and only constitue a small proportion (0.1 percent) of the overall national poultry population.

Chicken and Duck Production Systems

While there are various classifications of poultry production systems based primarily on scale, official classification criteria have not been established by Cambodian authorities. Thus, for explanatory ease, this report uses a previously adopted threefold classification system to describe chicken and duck production in Cambodia: (**A**) traditional, small-scale, extensive backyard/garden poultry production, (**B**) semi-intensive, small to medium scale, market-oriented, commercial chicken/duck production, and (**C**) intensive, large scale, industrially-integrated chicken/duck production.

A broad visual overview of the number of flocks and birds by production system in 2003, before the advent of HPAI in Cambodia, is provided in figures 5 and 6 respectively.

Figure 5. Number of flocks by production system in Cambodia in 2003 (n ≈ 1.9 million).

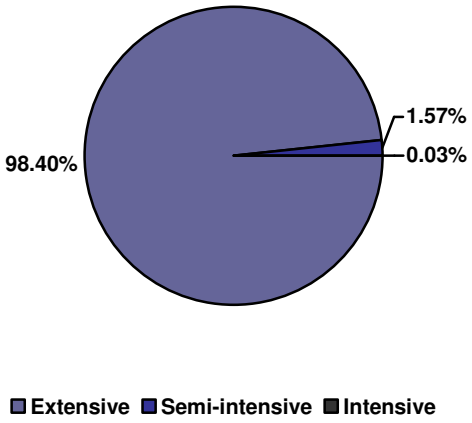
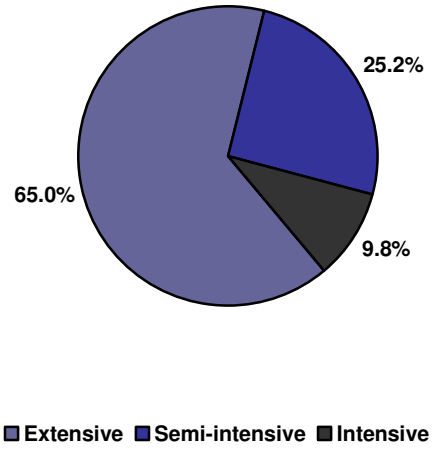


Figure 6. Number of birds by production system in Cambodia in 2003 (n ≈ 16 million).



Source: Authors' estimates based on Cambodia Socio-Economic Survey (CSES) 2004 and MAFF 2006.

Traditional, small scale, extensive backyard/garden poultry production

This type of poultry production system accounts for approximately 70 percent of the Cambodian poultry population and, based on analysis of the CSES - 2004, is practiced by around 60 percent of rural and 25 percent of urban households[1]. Three fourths of poultry keeping households raise chickens only, with the remaining one fourth raising both, ducks and chickens. Average flock size is less than ten birds and rarely exceeds 30 birds.

Poultry is raised in backyards, gardens, roofs, orchards and often free to range on neighbouring lands. Most of the chickens raised are of local breeds that have been kept by farmers over generations, some of which are: Skouy, Sampeov and Kragnas. For ducks these are: Tear Angkam (layer), Tear Sampeov (broiler/layer), and Tear Kapa (Muscovy duck). These local breeds are of low productivity in comparison to foreign-imported breeds. The initial economic resources in the form of permanent investments to start this poultry production system are quite small or almost negligible. Housing, although very basic in some cases, can be nonexistent. Birds sleep in trees and natural sheds at night. The cost of inputs can be a small cash expense for the purchase of day-old chicks (in case own-stock hatching is not pursued) and some complementary feedstuffs. For the most part, when a mature chicken and cock are owned, there is no need to purchase day-old chicks (DOC) because own-stock hatchlings are used. Most farmers keep poultry all year as a source of food and as sideline income.

Depending on the region, supplementary feed is purchased by between 5 and 25 percent of the chicken owners but grains produced on the farm by a majority in most regions. Other feed sources that are provided include kitchen waste and agricultural by-products from where they scavenge. The amount of feed given to birds does not focus on increasing production and once the birds have reached a certain weight, ranging between 1.0 and 1.25 kg, they are slaughtered and consumed. If there are more chickens or ducks than needed to cover family nutrition, birds are sold live locally or at farm gates, were motorized traders and middlemen purvey supplies to take to markets. Poultry are thus also an important source of cash income for low-income households. Cash revenue is usually used for re-investments, repairs, medicines, education, clothes, shoes and purchases of non-grown

[1] Many cities have bird densities ranging from 230 to 770 birds per square kilometer.

food items at shops and markets. Duck eggs are either consumed or sold/traded. Chicken eggs are rarely sold because they are kept for stock renewal.

High mortality due to diseases is a common yearly occurrence especially during the period March-May. On average, 5 to 7 percent mortality per month is considered normal. The use of veterinary services and of vaccines is rare. Four fifths of rural poultry owners say they do not need formal credit programmes, animal health services, technical advice and government interventions to raise their birds.

Semi-intensive, small to medium scale, market-oriented, commercial chicken/duck production

This type of poultry production system operates at relatively larger scales, uses more developed infrastructure, and has a higher rate of commercialization than the system described above. It is considered to be a transitional stage between traditional and intensive large-scale poultry production. For the purpose of this report, flock sizes ranging from 50 to 2,000 birds are classified as falling into this production system.

Besides reliance on naturally available feed resources such as worms, insects, pests, vegetables, and grass that small flocks can scavenge, chickens and ducks are provided with locally manufactured animal feeds, and sometimes supplemented with feed additives (i.e. enzymes) to enhance the nutritional values of diets. Day-old birds of imported breeds are bought at local hatcheries and indigenous chicks are obtained at local markets or by own-stock hatching. Housing varies from permanent to makeshift enclosures made with local primary building materials, such as mud bricks or bamboo, or tree branches. Gardens are fenced with nylon netting or bamboo material or walled with bricks. Bio-security measures for disease prevention, treatment and management are given more attention compared to traditional backyard raising systems.

This system has production cycles for meat birds of about 70 to 90 days, with intermediate mortality rates and efficiency levels. Similarly to traditional, small scale, extensive backyard/garden poultry raising, commercial production outputs consist of poultry meat (breast, wings and drums), eggs (white and brown), live birds including growing chicks, broilers, laying hens, cocks, and other poultry species like ducks and geese. These outputs have more formal marketing avenues, such as local contracts, direct market delivery and selling to established middlemen/experienced traders.

A relatively large share of these semi-intensive, market-oriented, poultry flocks are commercial duck (broiler and layer) farms. In 2004, in a countrywide survey, the Department of Animal Health and Production (DAHP) recorded 951 duck farms with an average of 875 ducks per farm (based on flock size criteria, some of these duck farms would fall into the intensive, industrial production system category). Semi-intensive, commercial duck farms are generally less standardised than commercial chicken farms, with 30 percent of ducks raised as broilers and the remaining 70 percent raised as layers. Initial investments are higher than in traditional/backyard systems but lower than in commercial, intensive chicken/duck raising systems.

Ducks are usually raised outdoors near lakes and man-made ponds. Management practices vary by flock size, number of years in business, product specificities and local market prices. Duck raising cycles coincide with rice production periods (with some farmers moving their duck flocks long distances to feed on rice paddies, sometimes, all the way south to northern Viet Nam's Mekong delta) and peaks of demand. Production may be interrupted for a few months. High quality commercial feeds are offered during the first two weeks of rearing but a transitional lower-quality fattening feed is provided afterwards. Often, the feeds are manufactured on-farm.

A formal supply chain is in place with hatcheries supplying ducklings (local, small-scale duck breeding is pervasive, with many provinces producing native ducklings and fertile duck eggs for sale or

incubation). However, the small-scale local breeders cannot satisfy the demand for ducklings and as a result imports from Thailand and Viet Nam flow to provinces that do not host hatchery-breeding farms. As a general rule, nationally produced ducklings are sold to smallholding production units during May and to commercial units during October. Feed manufacturers supply feedstuffs, and lenders supply short-term capital to fund these duck raising operations. Most contracts are verbal.

Intensive, large scale, industrially-integrated chicken/duck production

Intensive, large-scale, industrially-integrated poultry raising farms are a new development in Cambodia. These are modelled after industrial poultry systems found in high income countries and rely for layers on in-house cage systems accommodating internal feed and water supply, controls for humidity, air, and waste management systems. Farms with automatic equipment have sizes in the 10,000 to 15,000 bird range and above. 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 levels of flock productivity compared to the previously described systems.

Breeds raised in industrial-scale farms are bought at regional foreign-owned hatcheries (i.e. Aviagen, Hybro). In the case of broilers, production cycles are between 42 and 45 days (about 6 weeks) and birds weigh about 1.75 - 2.0kg when finished, while layers produce 255 to 275 eggs per year. Average investment in an industrial chicken farm is about US$ 3,750 per one thousand birds. The scale of employment depends on the number of houses, flock size per house, and availability of local labourers. Large farms hire from 12 to 18 employees. Industrial systems may employ fewer workers per unit of output, but these workers acquire specific skills by working with advanced technologies.

Commercial Breeding Farms / Hatcheries

Breeding farms raise the parent stock that produce fertile eggs which, after incubation and hatching, pass chicks to the production sector. There is one chicken breeding farm in Cambodia, which is foreign-owned that produces day-old-chicks for broiler farms and pullet / layer farms. At this time, there are no breeding farms for local breeds of chickens. In the case of ducks, DAHP reports 30 large-scale hatcheries.

Intensive Industrial Chicken Broiler Farms

In 2004, DAHP recorded 108 chicken broiler farms; with an average of 3,588 broiler chickens per farm. Out of these 108 farms, 70 were contracted private farms doing business exclusively for the CP group[2] while the remaining 38 were non-contracted private farms.

CP introduced production contracts in the late 1990's, whereby CP supplies DOCs, feedstuffs, feed additives, veterinary products and technical expertise. Cooperatives and private producers of varying sizes commit their labour, equipments and farm infrastructures and assume part of the financial risk. An 'all-in and all-out' production scheme is used. The entire output is delivered to CP slaughterhouses. Owners receive performance-based compensation (i.e. paid by number of healthy live birds at 45 days or reaching a contract-specific weight). Bonuses are paid to efficient contractors.

Non-contracted private farms work differently: Commercial balanced feeds are provided to chicks only during the first 7 - 9 days. Afterwards, farm-made diets are manufactured using local raw ingredients (corn, soybean and fishmeal), by-products (wheat, brewery yeast and rice bran), premixes (vitamins and minerals) and additives (enzymes). Inclusion levels into diets vary according to price of ingredients, nutritional needs, age of birds and type of breed used. DOCs are imported by independent Phnom Penh-based firms and sold to private farms according to needs and production

[2] Charoen Pokphand (CP) is a Thailand-based global multi-business conglomerate founded in 1921 that has operations and investments in poultry production, agribusiness and crop integration, pet food manufacturing and seed fertilizers. CP started operations in Cambodia in 1995 - 1997, and introduced medium, large and industrial-scale commercial poultry production models.

levels. CP is also penetrating this business segment, and supplies close to 50 percent of DOCs to private farms that are not under contract.

Intensive commercial farms serve as major suppliers of poultry meat to highly populated cities such as Phnom Penh, Battambang, and Siem Reap. Cities/towns may host anywhere from 1 to more than 40 broiler farms, with populations ranging between 1,000 to 200,000 broilers (Table 3).

Table 3. Cities/towns with more than 15,000 broiler chickens, Cambodia, 2004.

City/Town	Farms	Number of Broilers
Kampong Speu	41	204,900
Kandal	18	63,032
Phnom Penh	10	37,085
Siem Reap	16	30,780
Takeo	5	19,296
Battambang	6	18,000

Source: VSF, 2005.

Intensive Industrial Chicken Layer Farms

Commercial chicken layer farms produce white and brown eggs for human consumption and the manufacture of food products. These eggs are infertile. The average selling price per egg is KHR 375 (equivalent to US$ 0.09). In 2004, DAHP registered 74 chicken layer farms of which 65 are independent while the remaining 9 are contracted with CP. The average layer flock size is 5,213 birds. Pullet raising farms, of which there are close to 60 (from small to medium-scale), are exclusively producing replacement layers. Layers get replaced when egg production has dropped below 60 percent lay and are sold to smallholder farmers or slaughtered.

Breeds used in layer farms are mostly non-local (i.e. 95 percent is foreign). High-end producers and CP-contracted farms use only commercial balanced feeds throughout the laying cycle while other producers may use farm-made feeds once birds are 7 to 10 days old. When laying rates descend below 60 percent the birds are either sold locally (KHR 3,500/kg, equivalent to US$ 0.90/kg) or culled and replaced. Replacement is done with DOCs or growing layers (young and mature). A recent market survey showed that about 83 percent of the sold chicken eggs came from improved breeds and thus from commercial farms. Neighbouring Thailand and Viet Nam have bigger egg laying businesses than Cambodia, and their economies of scales coupled with cheaper feedstuffs enable them to produce cheaper table eggs which reach Phnom Penh and Siem Reap market outlets. The market survey demonstrated that about 11 percent of the chicken eggs and 36 percent of the duck eggs were from neighbouring countries.

The layer industry is geographically concentrated in two cities: Kandal and Kampong Speu, which jointly host almost 80 percent of the entire chicken layer population. Cities/towns may host anywhere from 1 to more than 45 chicken layer farms, with populations ranging between 4,000 to 160,000 layers (Table 4).

Table 4. Cities/towns raising more than 10,000 layer chickens, Cambodia, 2004.

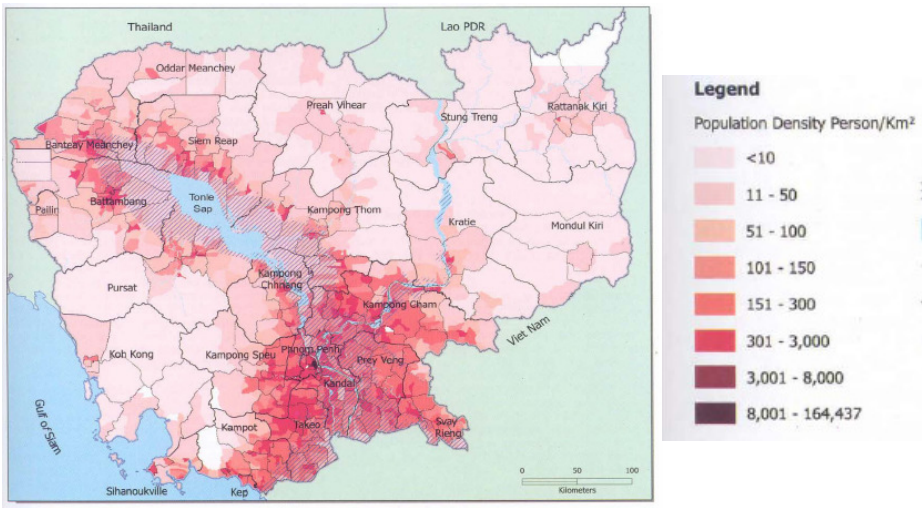
City/Town	Farms	Number of Layers
Kandal	46	158,395
Kampong Speu	8	148,000
Phnom Penh	5	42,955
Siem Reap	6	10,920

Source: VSF, 2005.

Geographic Distribution of Poultry Production

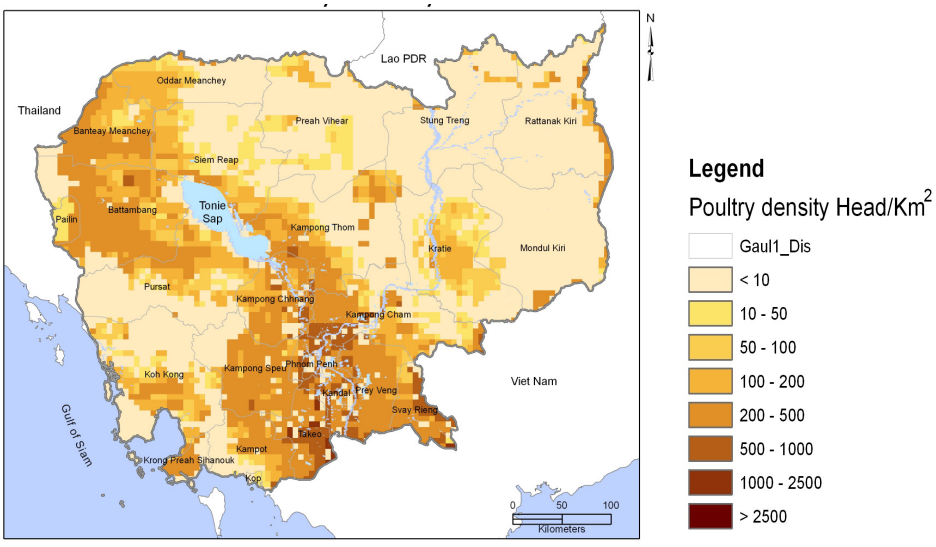
In Cambodia, poultry densities directly correspond to human population densities (Figure 7 and 8), that is, both are high in regions that have cities serving as hubs for agricultural, commercial and industrial activities (i.e. Phnom Penh and the communes surrounding Tonle Sap Lake). Thus, poultry density is highest in the south and southeast (bordering Viet Nam and close to the Mekong river area) and also high in the northwest (bordering Thailand).

Figure 7. Human population density in Cambodia, 2005.



Source: NIS, 1999.

Figure 8. Estimated poultry density in Cambodia, 2005.



Source: Produced by FAO, AGAL.

Most poultry are kept within the region of the Plain Valley (40 percent) and Tonle Sap Lake (37 percent). The remaining proportions are shared between the coastal regions (11 percent) and the plateau and mountain regions (12 percent) as shown in Table 5.

Table 5. Poultry numbers by regions and species in Cambodia, 2003.

Regions	Chickens	Ducks	Geese	Pigeons
Plain Valley	4,500,000	1,450,000	700	250
Tonle Sap Lake	4,800,000	650,000	2,600	0
Coastal	1,100,000	490,000	1,750	1,650
Plateau & Mountain	1,700,000	180,000	250	50
Totals	12,100,000	2,770,000	5,300	1,950

Source: DAHP, 2003 census; rounded numbers.

Input Supply, Service Provision and Marketing

In Cambodia, the Government is not engaged in the poultry production sector. With its development, collateral business have emerged to service the needs of producers, be it in the form of purveying feeds, chicks, medicines, materials and equipments.

Wholesale importers of chicks and animal feeds

Broiler and layer chicks are bought in Thailand and Viet Nam. Purchase volumes range from 80,000 to 175,000 chicks per month, with buyers placing orders well in advance according to production schedules and housing availability. Commercial balanced feeds poultry (and pigs) are also bought in Thailand and Viet Nam-based feed mills. Feeds are delivered either at factory gate or trucked to the closest legal border crossing. Feed purchase volumes vary with season, cost of ingredients, chicken and duck production levels, numbers of purchase orders and hauling distances, ranging from 75 to 125 tonnes per month. The distribution and actual delivery of orders is organised through 20 to 25 truck-owning distributors spread through different provinces or simply by loading up privately-owned vehicles at wholesale storage gates. There are 2 to 4 major wholesalers working out of Phnom Penh with many smaller wholesale agents operating at provincial scale. Enforcement of import regulations (i.e. import bans levied) is weak.

Specialty animal health product distributor: Medivet

Medivet is a national company with 20 employees. Their staff is composed of animal health professionals and salesmen that provide frequent technical product support and expert advice to poultry farmers using their products. Originally, their business started exclusively as a specialty animal health product distributor, mainly selling branded vaccines, premixes and antibiotics via provincial distributors and directly to farms; nowadays, they have ventured into Thailand-imported chick sales in the order of 25,000 broilers and 15,000 layers per month. Most sales (85 percent) are done directly to poultry (and pig) farms.

Wholesale importers of veterinary products

These firms sell vitamin and mineral premixes, de-wormers, vaccines, antibiotics, fungicides, antiviral drugs and over-the-counter medicines. They do so mainly through distributors strategically dispersed nationwide or directly to large farms with sizeable purchase invoices. Poultry represents anywhere between 10 to 60 percent of annual sales for these wholesalers, with the remaining sales from other species, mainly pigs. Three major entities control this market: Navetco, a Viet Nam-managed firm representing Asian companies; Thom-Thom, a French/Cambodian-managed firm representing European companies (also provides technical support and expert advice to poultry farm on a regular basis); and VE, an Indian-managed firm representing British and Indian companies.

Commercial animal feed and veterinary product distributing stores

Stores that supply animal feed and veterinary products are co-located with production hubs. At times, these distributing stores serve as meeting points for producers, veterinarians and agronomists

to exchange information. These stores work as intermediaries, that is, they make a profit out of buy-sell margins. Many store owners are themselves livestock farmers that attempt to reduce cost by opening up local stores, and by doing so, aim for an alternative income.

Veterinarians and para-veterinarians

Animal health professionals providing services in Cambodia can be divided into two groups: state veterinary agents and private veterinary practitioners (licensed or non-licensed). The Ministry of Agriculture, Forestry and Fisheries based in Phnom Penh has entrusted the DAHP the critical role of supervising 24 provincial animal health and production offices. These provincial offices manage their tasks through 184 district offices. There is total of 250 veterinarians and 250 animal production experts in Cambodia, most of them employed in Phnom Penh. The veterinarians have degrees obtained at local universities or are individuals with accrued field experience dealing with endemic diseases. They focus primarily on livestock such as pigs, buffaloes, poultry, meat and dairy cattle. Government compensation for these provincial positions is low.

From the mid 90's private animal health professionals started to be promoted by the Government of Cambodia. A key component is a Village Animal Health workers (VAHW) system, officially recognised by law since 2001. These VAHWs are registered with and trained by DAHP, with external support (NGOs, FAO). In the urban and peri-urban areas they deal not only with livestock but also with small non-productive animals and pets. They are usually village, town and city neighbours that have opened a veterinary clinic in their homes or just advertise their services in local fresh food markets. Para-veterinarians (or paravets) do not have formal veterinary education yet they are well versed in many aspects of animal health due to their field exposure. Training as paravet is a technical degree choice for young Cambodians wanting to rise above poverty or charity.

Civil society organizations ascertain that more than 5,000 village animal health workers (VAHW) have been trained by NGOs working in rural and urban Cambodia. FAO has trained as much as 5,650 VAHW under the HPAI prevention and control programme since 2006. In total 8,150 VAHW are formally recognized by DAHP. According to NGO statistics there are at least 2 VAHW per commune or at least 1 VAHW per 150 rural households.

When asked whom they contact about animal health problems, smallholders prefer VAHWs whereas commercial farmers prefer state veterinarians. Again, when asked whom they contact for technical advice the answer was VAHWs and state veterinarians. A striking fact, however, is that almost four fifths of smallholders do not ask anyone about animal health related problems or for technical advice.

Financing and credit services for poultry operations

Non-governmental organizations have played a pre-eminent role as financing entities in rural settings (i.e. micro-credit). Most of these are selected as implementing institutions for international organizations (i.e. FAO, World Bank, WHO), foreign affairs department programmes of donor countries, and charity accounts of multinational corporations. They are selected based on credibility, programme success rates, number of volunteers, coverage and scope of aid. They require formal credit applications and follow-up on loans with farm visits and verbal feedbacks.

Other sources of finance are relatives, cooperatives, wealthy friends and farmers' associations. Commercial banks usually lend money only to large, established concerns and vertically-integrated farms. The most common form of credit is informally engaged by wholesalers, feed retailers, hatcheries and suppliers. Only a small percentage of smallholder farmers (15 percent) require credit to fund their operations.

Poultry and poultry product marketing

A large share of poultry output from traditional extensive productions is consumed by households. Whatever is left after satisfying the needs of family nutrition is destined for sale. Poultry sales occur either at farm gate to traders/middlemen or directly to shops and markets. Traders/middlemen are key agents in poultry marketing. They own bicycles, motorcycles and cars to transport live birds, meat and eggs collected from farmers to food markets. Depending on the method of transport, they aggregate into three collaborative groups: 1) Several bicycle-owning middlemen collect at farm gates of producers in their respective commune or village for 2) motorcycle-owning middlemen who himself, along with others, collects in communes, villages and towns, and transports longer distances for 3) car-owning middlemen that finally move and sell the accumulated outputs from communes, villages, towns and districts to market retailers in their respective or neighbouring provinces.

Poultry marketing proves to be dynamically complex with a diversity of traders/middlemen interacting at every level in the supply chain. Only a small percentage of the total number of birds brought to urban centres from rural areas are sold in live bird markets (ADI, 2007). Market retailers and sizeable restaurants requiring live birds and coloured eggs place orders to specialty trader/middlemen that bring them directly to them for a small fee. Another version of market arrangement occurs with 'poultry shuttles': these pick-up trucks drive daily from Prey Veng and Svay Rieng provinces to the capital using main thruways. Motorcycle drivers hired by retail shops transport live birds from a 'poultry shuttle' highway stop into markets. Only local, native birds are hauled. Middlemen also unite and rent a vehicle for KHR 25,000 (equivalent to US$ 6.50) to haul poultry and eggs from Kompong Thom to Phnom Penh. A Few marketing cooperatives are also in this business.

Poultry and Livelihoods

The Cambodian economy remains largely agrarian, with livestock playing an integral role in rural farming systems that include cattle, buffalo, pigs, and poultry (chickens and ducks). Numerous rural households keep small livestock around their homes. Poultry production has been highlighted as a tool for poverty reduction with the potential of promoting rural economic growth and minor improvements of people's livelihoods.

The Contribution of Poultry to Household Income

Poultry production is normally one of the many activities in diversified rural farming systems. Crops usually provide more income than livestock, and at other times, job salaries are higher than both. Backyard poultry raising in Cambodia contributes to supporting livelihoods by providing food that otherwise would need to be purchased and as a source of easy-to-convert cash to cover minor household expenses.

As shown in Figures 9 and 10, households in all income quintiles raise poultry, mainly in the traditional extensive mode. Poultry keeping is least prominent in the poorest (Q1) and the richest (Q5) households, while around 60 percent of households in the three middle income groups keep some more poultry.

Figure 9. Poultry keeping and production system by income quintiles (values for 2003).

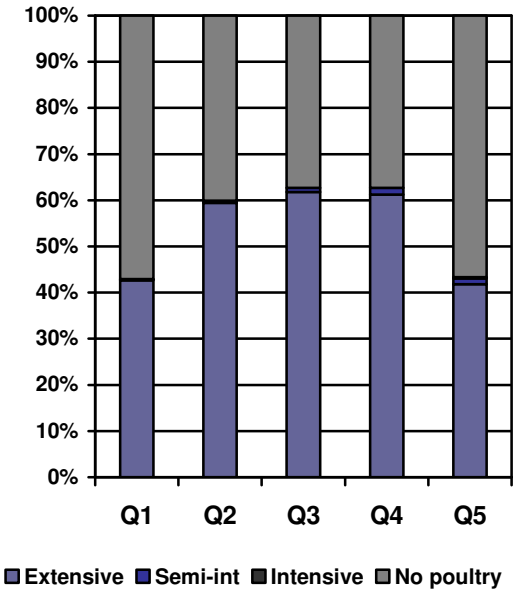
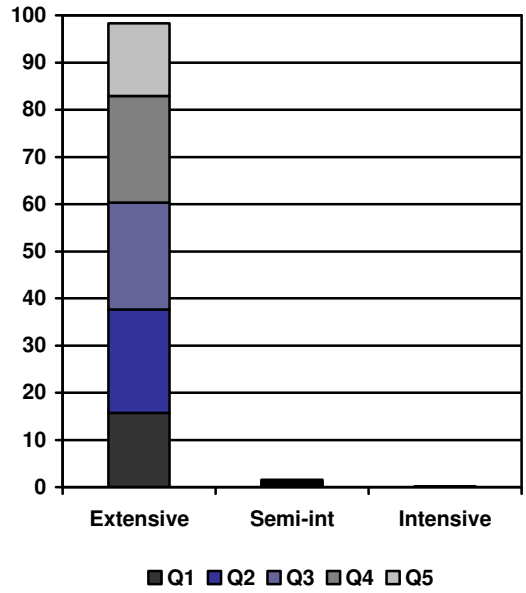


Figure 10. Income quintile distribution by poultry production systems (values for 2003).



Source: Authors' calculations based on CSES, 2004.

In most households, across all five income quintiles, revenues from poultry represent only a very small proportion of total annual household revenues (Figures 11 and 12). Although lower income quintile households on average receive a larger proportion of their income from poultry than higher income households, this contribution is still quite low, which may explain why poultry diseases are not usually a primary concern of rural households.

Figure 11. Total annual revenue and revenue from poultry (Thousand KHR) by income quintiles (values for 2003).

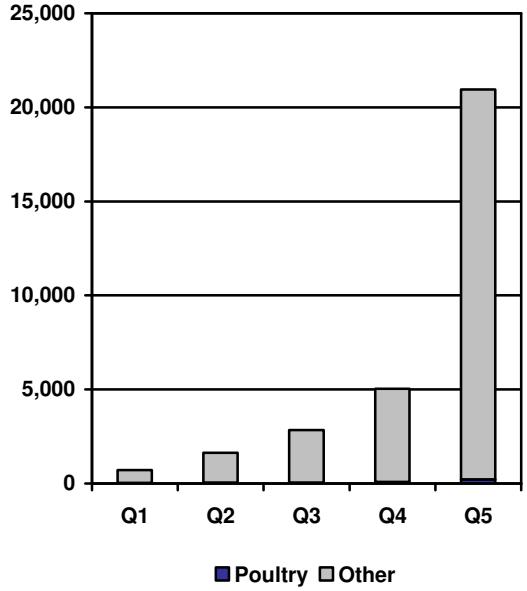
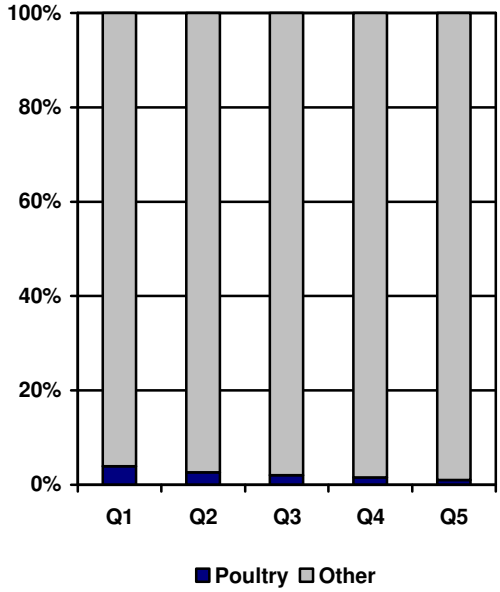


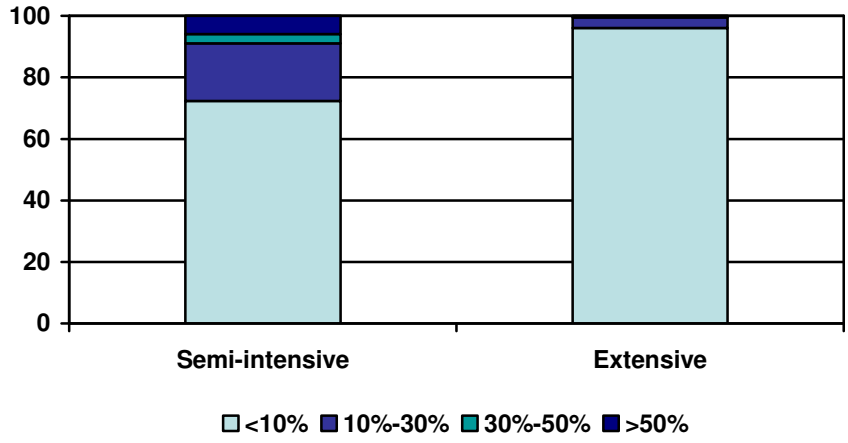
Figure 12. Share of total annual revenue from poultry (%) by income quintiles (values for 2003).



Source: Authors' calculations based on CSES, 2004.

The vast majority (>90 percent) of households engaged in traditional, extensive poultry keeping, obtain less than 10 percent of total household revenue from this activity (Figure 13). Even for households engaging in semi-intensive poultry production this activity often (approx. 70 percent of households) seem to only be a secondary or tertiary source of income, while for a minority of households (approx. 10 percent) it does provide more than one third of their total income.

Figure 13. Income share from poultry for traditional and semi-intensive poultry producers in Cambodia (2003).



Source: Authors' calculations based on CSES, 2004.

Estimates of income from poultry as proportion of total income may underestimate the importance of poultry to livelihoods as these estimates do not take into account to whom within a household this income accrues. This has also been posited by NGOs in the field, whose direct work with farmers brings anecdotal reports of the importance of poultry in women's lives (ADI, 2007). Furthermore, cash in hand may be an important consideration for poor households and in a study carried out by

VSF (2005) poultry-derived cash income as a proportion of total income for a selected sample of rural households ranged from 9 to 13 percent, depending on income stratum, with an average of close to 11 percent (Table 6).

Table 6. Cash income from poultry meat and egg sales by household (HH) income stratum in Cambodia (as share of total income).

Type of Income	Low income HH	Med Income HH	High Income HH	Average
Cash	12.6%	10.9%	9.1%	10.9%

Source: VSF, 2005.

Household Food Expenditure and Consumption Patterns

On average, Cambodian households spend roughly 62 percent of their budget on food purchases. However, food expenditure shares vary by location and are 39.6 percent for Phnom Penh residents, 58.5 percent for other urban residents, and 69.5 percent for most rural residents (Ministry of Planning, 2006). Cereals are the largest food item group, both in value and calories. Expenditure on poultry meat and eggs comprises 3.2 and 1.4 percent of food purchases, respectively, values which are relatively low compared to expenditures on rice, fish and non-poultry meat, which comprise 15.6, 8.9 and 5.0 percent of total food purchases, respectively.

A rapid rural assessment performed by VSF (2005) found an average expenditure of US$50 per month for food for households of 5 to 6 persons, which translates into an average food expenditure of about US$9 per month per person in rural areas (Table 7). This value does not take into account home-production consumption.

Table 7. Household food expenditure in rural Cambodia, 2003 – 2004.

Description	Value
Average monthly food expenditure* per household (US$)	50.0
Average number of persons per household	5.5 (3.7 adults & 1.8 children)

Source: VSF, 2005; * only considers food purchases and not home-production consumption.

A rural Cambodian household consumes about 154 grams of poultry meat and 4 to 9 eggs per week (Ministry of Health, 2001). Average individual consumption in rural areas would thus be around 30 grams of poultry meat and 1 to 2 eggs per week. Specific consumption varies with household income, proximity to markets, and prevailing market prices.

Consumer Preferences for Poultry

The most commonly available types of chickens are birds of local breeds raised in traditional production systems. A comprehensive market survey found that about 87 percent of the chickens sold in markets were of local breed and nearly all ducks were also local. The chickens are marketed at approximately 1.25kg of live weight and command a higher market price than industrially produced broilers. The latter are marketed at approximately 1.75kg of live weight but are in lower demand because of taste and meat texture characteristics. The average market price for slaughtered chickens in spring 2008 was 17,860 KHR (US$4.35). [Olaf Thieme, Personal Communication].

Duck meat is bought and eaten during festivities, with local breeds marketed at 1.8kg and non-local breeds marketed at 2.75kg live weight. The average market price for slaughtered ducks in spring 2008 was 12,650 KHR (US$3.09), which is lower than the price for chickens.

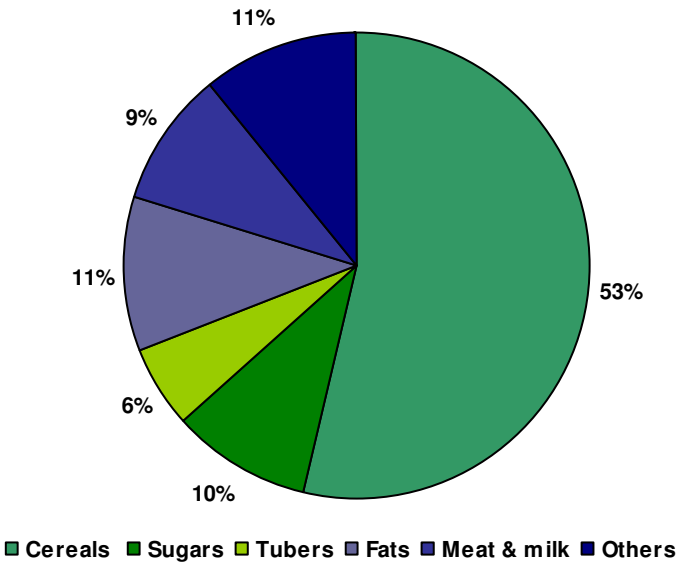
As for eggs, duck eggs fetch prices from 450 KHR compared to 400 KHR for a chicken egg (VSF, 2005; Olaf Thieme, Pers. Comm.). The market survey found that almost 83 percent of the chicken eggs were from improved breeds and thus most likely from the commercial producers or imported.

The Contribution of Poultry to Nutrition

Despite dietary improvements, malnutrition levels are still high at the national level (malnutrition in children from 6 to 51 months-old continues to be a major problem). However, levels of food insecurity and vulnerability vary substantially by geographic region and by social group within Cambodia and are particularly pronounced in rural populations that are far away from towns, market hubs and health care centres (e.g. the very poor in the mountainous highlands) and those that have been severely affected by multiple shocks.

Cereals (mostly rice), refined sugar products, and tubers contibute nearly 70 percent of the estimated caloric intake in average Cambodian diets (Figure 14). Livestock products contribute around 9 percent to caloric intake, and from this, poultry meat accounts for around one quarter (2 to 3 percent of total calory intake). Chicken meat is lean and high in protein and supplies significant amounts of micronutrients, such as iron, zinc and vitamins. Eggs provide proteins and substantial amounts of several important vitamins and minerals, such as vitamins A and B_{12}, folate, thiamin, riboflavin, phosphorus, and zinc.

Figure 14. Estimated caloric contribution by food item type in Cambodia*, 1999 – 2001.



Source: FAOSTAT, 2004; * based on 2,675 calories/person/day for developing countries.

Although frank micronutrient (vitamins and minerals) deficiencies are rare, low consumption of green vegetables has been identified as a recurrent source of dietary imbalance. As a consequence, there are still cases of night blindness in children and pregnant women (FAO, 1999).

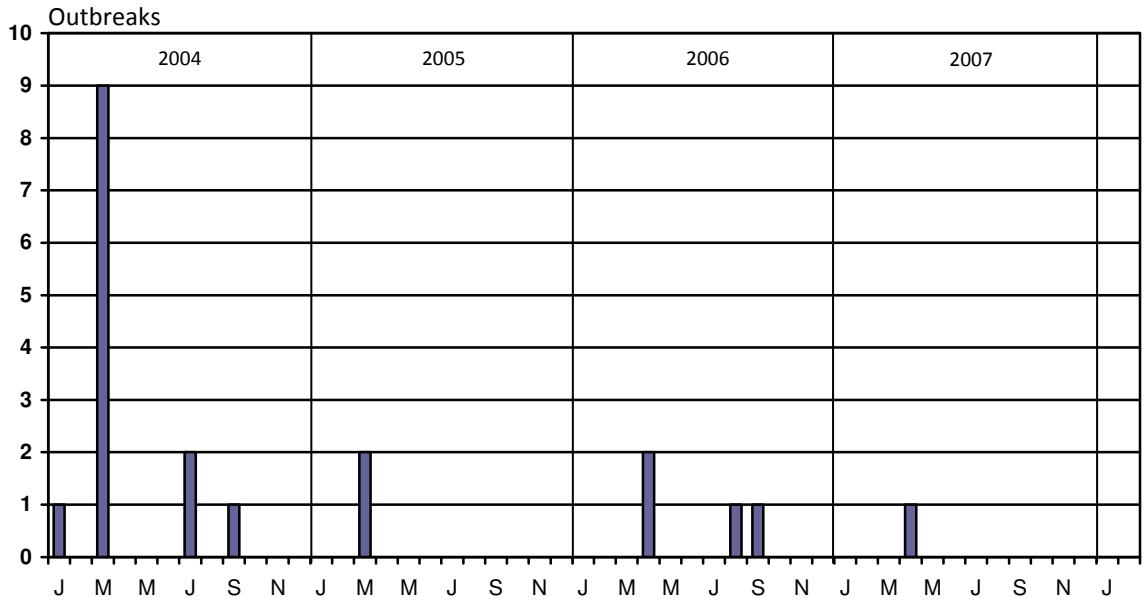
The HPAI Epidemic: Course and Institutional Response

Compared to neighbouring Thailand and Viet Nam, Cambodia experienced only a mild HPAI epidemic. The following provides an account of the course of the HPAI epidemic and institutional responses mounted by the Cambodian animal health authorities.

Course of the HPAI Epidemic

In total, there have been 20 HPAI outbreaks comprising a little over 21 thousand birds (chickens, wild birds and ducks) in Cambodia reported to the Office International des Epizooties (OIE) between January 2004 and February 2008[3]. The first outbreak was reported in late January 2004 and affected a chicken layer unit with 7,500 birds in the vicinity of Phnom Penh. So far, the last case of HPAI was recorded in mid-April 2007 and affected a large chicken/duck unit (Annex 2). The temporal and spatial patterns of HPAI in poultry are displayed in figures 15 and 16.

Figure 15. Temporal pattern of HPAI outbreaks in poultry in Cambodia, 2004 - 2008.



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

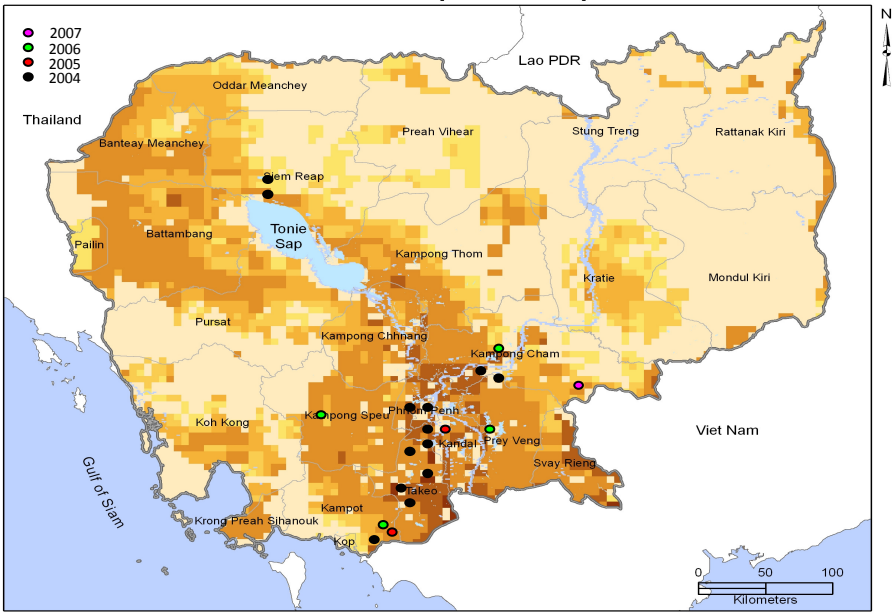
Thirteen of the twenty outbreaks, or 65 percent, occurred in March - April of successive years, while six outbreaks (30%) have occurred in July, August and September. Both of these periods coincide with the release of ducklings into newly planted rice fields in the Mekong River valley located south of Cambodia. Apart from two outbreaks in Siem Reap province (in the north), HPAI outbreaks in poultry have been recorded along the Mekong River, the Tonle Sap River and Basaac River, and with few exceptions, close to major transit roads. In total, approximately 20,000 birds died specifically from HPAI.

Four of the twenty outbreaks recorded in domestic poultry, i.e. one fifth, have occurred in large, industrial units, although these make up less than 0.1 percent of the total number of registered poultry operations. This may indicate the overrepresentation of industrial poultry units in the distribution of affected holdings and may be partly attributable to under-detection / under-reporting

[3] According to FAO Cambodia 5 outbreaks occurred in January 2004, increasing the total number of outbreaks to 24.

of HPAI in backyard systems but may also be a result of increased risk of infection of this type of unit related to movement of inputs on to and the removal of outputs from farm premises.

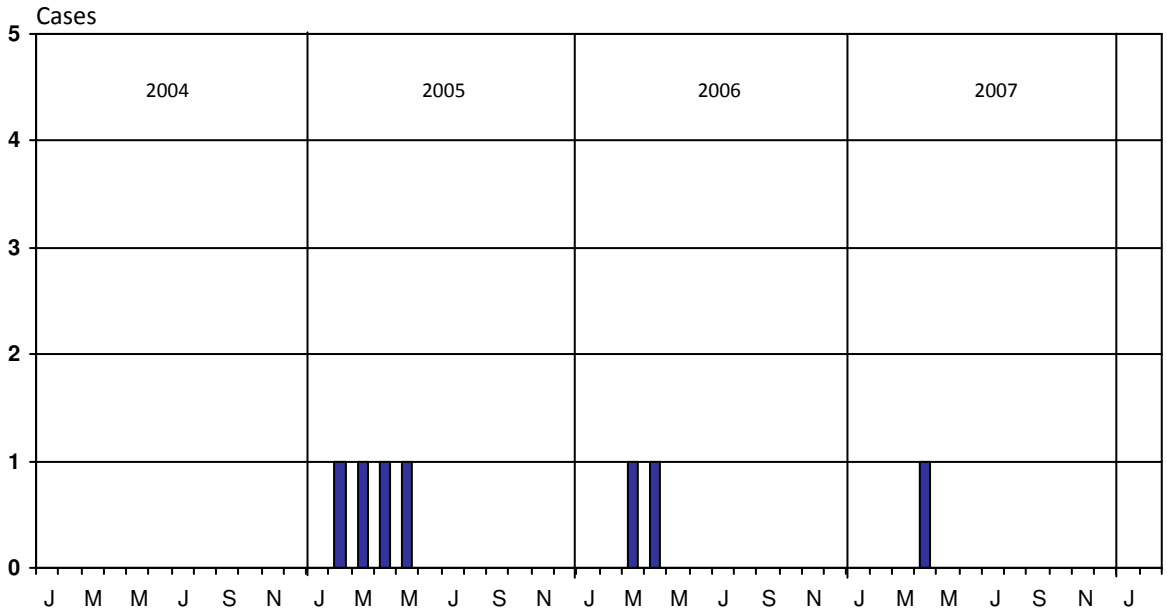
Figure 16. Spatial distribution of HPAI outbreaks in poultry, Cambodia, 2004-2007.



Source: Prepared by FAO, AGAL, 2008; dot locations based on Vong and Buchy, 2008.

With the exception of 2004, the temporal occurrence of recorded HPAI infections in humans (all of which have proven fatal in Cambodia) roughly coincides with periods of HPAI outbreaks in poultry. The HPAI case in a female in Kampot province in February 2005, before official reports of HPAI in poultry, indicates undetected or unreported disease occurrence in poultry.

Figure 17. Human cases of HPAI in Cambodia, 2004 – 2008.

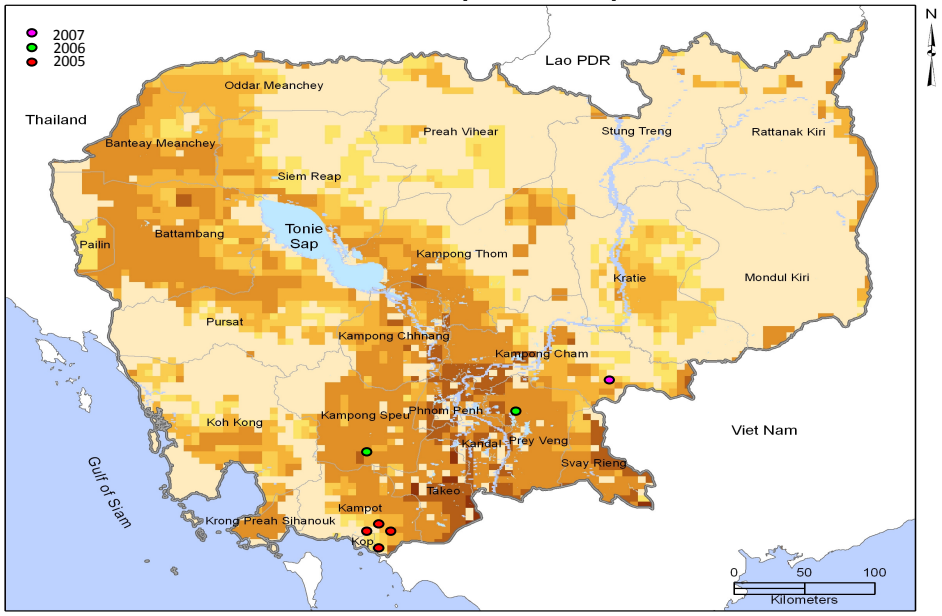


Source: World Health Organization, 2008; all confirmed cases resulted in death.

Of the seven human cases of HPAI recorded in Cambodia, four occurred in Kampot province in 2005 (this province is adjacent to Viet Nam's high duck-producing areas). Moreover, five out of seven (or 71%) human cases occurred in females, which normally tend care to birds in rural households (Annex 3 and Figure 18). All human cases detected occurred in individuals < 29 years of age.

The Institut Pasteur of Cambodia (IPC) carried out a series of human serological studies in households located within 1 km radius of the 2006 poultry outbreak in Kampong Speu Province (1-2 months after it was detected) and found H5N1 antibodies in 7 out of 674 individuals (Vong and Buchy, 2008).

Figure 18. Spatial distribution of HPAI in humans, Cambodia, 2004-2007.



Source: Prepared by FAO, AGAL; dot locations based on Vong and Buchy, 2008.

According to Ly *et al.* (2007) general media reports in Cambodia about HPAI through radio and television broadcasts appear to have been effective in creating high awareness and widespread knowledge about HPAI. However, rural Cambodians mostly continue to practice risky poultry handling. Improvement in risky practices can only be achieved through repetitive behaviour modification messages. Effective intervention programs must include feasible options for resource-poor households that have limited materials for personal protection (water, soap, rubber gloves, and masks) and must offer farmers alternative methods to safely work with poultry on a daily basis.

Animal Health Services and Institutional Response

Within the Kingdom of Cambodia, the Ministry of Agriculture, Forestry and Fisheries (MAFF) is responsible for all policy matters related to crops, natural resources, livestock, fisheries, agricultural services and forest development. Provincial departments of agriculture are located in the most populous and accessible cities within a province to implement and enforce legislations and programmes. Sero-surveillance in animals and humans is carried out in collaboration with IPC.

The DAHP is tasked with providing veterinary service assistance, to oversee appropriate development of livestock production systems, and for promoting sustainable animal production of different scales throughout the country. Hierarchically, there is a chief veterinary officer, followed by state and provincial veterinary agents, supervisors, and village animal health workers (VAHW), the lowest level of animal health officials. The latter are involved in helping groups of smallholders develop small-scale poultry. DAHP is represented by a VAHW in almost every village. These work closely with village

chiefs to implement animal health campaigns and activities recommended by MAFF, DAHP and NGOs. VAHWs provide advice, technical assistance and animal healthcare services, including vaccination and treatments. Before outbreaks of HPAI occurred in poultry, DAHP activities focused mainly on dairy and beef cattle.

After HPAI outbreaks started in Cambodia, the government imposed poultry movement restrictions and permitted culling of infected flocks (approx. 10,000 birds – commercial chicken, backyard poultry and free-range ducks - were culled) without compensation. Also, 3-km protection zones and 10-km surveillance zones were established around outbreaks. Temporary suspension of sales and purchases of birds was mandated. However, law enforcement is weak and compliance is left optional to farmers. Private veterinarians are poorly linked with the overall work of government veterinary services. It has been reported that various poultry sector stakeholders have remained in the sideline fearing government retaliation and do not report disease outbreaks or comment on the consequences of some of the implemented disease mitigation measures.

Current government campaigns encourage chicken raisers to move away from free-range systems and erect poultry fencing or build housing to improve bio-security. VAHW are encouraged to strictly follow government recommendations to showcase successful examples to other villages and villagers that these measures result in decreased mortality rates.

Provincial veterinary offices have established community hotlines to obtain feedback and reports about HPAI cases in humans and animals. Notifications are followed up based on subjective determination of urgency. Cambodia issues a weekly bulletin that reports on suspect and positive cases based mainly on results from an on-going duck and chicken market surveillance scheme.

Numerous national and international governmental and non-governmental institutions support the government of Cambodia in its efforts to control HPAI. Table 8 shows the presence of non-government institutions and their assistance focus for 2007 – 2009.

Table 8. Non-government institutions working in Cambodia and their assistance, 2007 – 2009.

Institutions	Assistance Focus
Wildlife Conservative Society (WCS)	animal health
World Health Organization (WHO)	human health + pandemic preparedness
United Nations Children's Fund (UNICEF)	education + capacity-building
US Naval Medical Research Unit (US NAMRU)	human health
Academy for Education and Development (AED)	education + capacity-building
Reproduction & Health Association Cambodia (RHAC)	human health
NGO Medicam	human health and pandemic preparedness
National Committee Disaster Management (NCDM)	pandemic preparedness
Ministry of Health (MoH)	human health
Asia Disaster and Preparedness Centre (ADPC)	education + pandemic preparedness
Ministry of Agriculture, Forestry and Fisheries (MAFF)	animal health
Pasteur Institute of Cambodia (PICA)	human health
Cambodia Red Cross (CRC)	education + capacity-building
Food and Agriculture Organization (FAO)	animal health
CARE International Cambodia (CARE IC)	education + capacity-building

Source: UN system coordination office in Cambodia, 2008.

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 down-stream 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

On a national scale, the official figure of 30,000 birds lost to HPAI constitute a mere 0.2% of the standing poultry population of 2003, the year before incursion of the disease and the risk of infection for any single flock was extremely low being in the order of 0.001 percent. Thus, in terms of the national economy, the impact of direct losses related to HPAI must be considered minor. The direct impact of the twenty HPAI outbreaks in Cambodia was mainly felt by the affected medium- and large-scale duck and industrial-integrated layer and broiler farms because for these, poultry represented a major source of income; while the impact on the infected small-scale, traditional backyard producers and depopulated neighbouring farms was comparatively less (CEDAC, 2007).

Flock losses from HPAI and uncompensated culling caused particular hardship for farmers that had borrowed from micro-finance and banking institutions to invest in their poultry businesses. There are reports of some distressed farmers selling household assets to pay back loans and credits, while others recovered their business thanks to the financial support from relatives living in urban centres or abroad. In some instances, local institutions provided assistance to farmers. In Kamakor village for instance, during the HPAI-prompted culling operations, provincial government officials provided some help to farmers (i.e. 300,000 riel for large-scale and 30,000 riel for small-scale farmers) but this was not considered official compensation because it was not mandated by law. The loss of animal assets in commercial and semi-commercial farms also prompted farm owners to lay off workers and to temporarily reduce the salaries of the remaining ones (from US$47 to US$28 per month).

Immediate Direct Impacts through Consumer and Market Reactions

One of the most common impacts of epidemic diseases, particularly if they can affect humans, is market shock. In Cambodia, the drop in demand for poultry products after announcement of HPAI led to temporary decreases in the prices of poultry in urban markets (e.g. from 4,000 to 1,500 Riels per kilo of broiler). Fear of HPAI prompted consumers to shift to other meats, fruits, vegetables and nuts, which made these and other food-basket items more expensive (and poor households had difficulties affording some food items that once were inexpensive). Generally, consumers' aversion to purchase poultry affected households whose income depended on frequently scheduled poultry sales, up to 20 percent, in a survey conducted by CEDAC (2007). The drop in prices severely affected market-oriented semi-intensive and intensive producers while small scale extensive rural producers reported that the market shock had minimal negative impacts on their livelihoods. Rural smallholders stated that when they could not sell their chickens at reasonable market prices they decided either to postpone sale or slaughtered birds as usual for food. In traditional poultry raising systems, scavenging chickens do not require large amounts of purchased feed, because they search food around the premises; therefore, keeping chickens for longer than normal does not increase production costs, as it does for industrially raised chickens (VSF, 2005). [4]

[4] The poorest households in rural communitie often do not keep poultry and depend on selling labour for farming and non-farming activities and in their community. These poor were hired even during HPAI outbreaks.

The reductions in bird stocks and unwillingness to sell poultry due to depressed market prices affected poultry trading in general. The impact was severely felt by middlemen and traders that saw declining transactions in villages and city markets. This effect was temporary and it came as a surprise to poultry-related business owners that a zoonotic disease of poultry could have so widespread effects on value chains upstream and downstream. By March 2004, however, prices for poultry products had recovered to their pre-HPAI level and even exceeded these levels by 25 percent later in the year (VSF, 2005) due to supply shortages, which resulted from bans on the importation of poultry products and DOCs from Thailand and Viet Nam.

Short-term Indirect Flow-on Impacts

In their survey conducted in July / August 2004, VSF (2005) found that after HPAI outbreaks there was a reduction in bird stocks of up to 40 percent as poultry producers were reluctant to restock due to uncertainty. Because farmers were keeping a temporary low production profile, they purchased lower amounts of feeds which in turn affected feedstuff purveyors and grain sellers.

Commercial producers were more severely affected by market uncertainty and production downtime. The government (MAFF, 2006) notes that when quarantine zones were established these were often maintained for too long a period for poultry producers to ride these out and, eventually, if they restocked at all, restocking was only partial. The ability of commercially-oriented farmers to restock was further impaired by a long-lasting ban on the importation of DOCs from neighbouring countries, leaving only the CP hatchery to supply the commercial sector (the price of DOCs increased from US$0.25 in December 2003 to US$0.33 in May 2004). As a result, the number of commercial layer farms dropped from 74 in 2003 to 52 in November 2004, while the number of broiler operations dropped from 108 to 92 over the same period.

Smallholder producers perceive that HPAI only occurs on commercial poultry farms with large numbers of poultry and fed with concentrate feed. They do not perceive HPAI as a serious threat to their livelihood, in contrast to threats such as losing a rice harvest, social insecurity or floods. Thus, poultry activities, be they small-, medium- or even large scale are restarted after crashing as long as farmers have the financial capacity to reinvest. One potentially overlooked impact of HPAI is the lower nutritional profiles of villagers due to the reduced number of eggs and meats consumed during outbreaks. Not only are poultry products avoided, but the purchase of alternative meats may not replace foregone intakes of poultry products because of higher prices for pigs and beef (VSF, 2005; CEDAC, 2007).

Medium- to longer-term Impacts and Adjustments

Poor women-headed families that previously depended on raising and selling chickens for cash at times of urgent need experienced difficulties raising pocket cash, but were able to sell poultry again a few months later. During this period, they had to find alternative livelihood strategies, such as selling rice cakes in the village or hand crafts. Job opportunities in the cities in construction, manufacturing and services are the main factor in determining alternative livelihood options. In Cambodia, after experiencing HPAI, only a very small proportion of farmers stopped poultry farming activities. Contrary to common perception, many have reinvested in poultry raising in an attempt to take advantage of higher market prices. Medium- and high-income rural households invested in agriculture, especially in ruminants, small herbivores, crops, and in transport and food processing. For those farmers with no financial means to reinvest in poultry keeping, the most common alternative livelihood strategy was migration to cities for jobs.

Conclusions

In Cambodia, the commercial, semi-intensive (mainly ducks) and intensive industrial (mainly chicken) poultry sector is (still) small in comparison to the traditional backyard sector as far as contribution to total national poultry production is concerned. However, demand for animal protein is rising rapidly due to rising overall incomes, population growth, and increasing urbanization. Domestic production, despite increasing rapidly before the advent of HPAI, could not satisfy the growing urban demand for chicken meat leading to legal and illegal import of poultry products from neighbouring countries, mainly Thailand and Viet Nam.

Cambodia's HPAI epidemic was mild compared to the epidemics experienced by Thailand and Viet Nam and the traditional backyard sector was largely spared from direct disease losses (approximately 0.01 cases per 1,000 flocks). The fledgling commercial sector however was severely affected by HPAI through market reactions and production downtime. This was mostly a consequence of government measures to control the disease, such as marketing bans and banning importation of inputs to poultry production, such as DOCs. A substantial share of commercial chicken producers, particularly those keeping layer chicken (nearly 25 percent), were unable to sustain income losses over longer periods and gave up poultry production.

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

As a country highly dependent on imports of inputs, DOCs 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.

Improving disease control and prevention require substantial improvements in national animal health capacities. Although the ultimate responsibility of ensuring national animal and public health rests with the government, implementation requires private sector participation. Therefore, there is a need to define the roles of the private and public sectors in the long term disease regulation and, given scarce funds, on the best focus for public sector efforts. Clearly, however, there is a need to strengthen animal health services, especially the linkages between the animal health service providers and the poultry producers to ensure successful prevention and control of HPAI.

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ANNEX 1. Demographics, Land and Socio-economic Indices

Human population	13.8 million
Population density	78.2 person/sq km
Annual population growth rate (1990-2000)	2.8%
Population in agriculture	9.6 million
as proportion of total population	69.3%
Total land area	176,520 sq km
Agricultural land	53,070 sq km
as proportion of total land	30.1%
Land under pasture	15,000 sq km
as proportion of total land	8.5%
Agricultural land per 100 people	38.4 ha
Agricultural land per 100 people in agriculture	55.4 ha
GDP (constant at 1995 US$)	5,200 million
GDP annual growth rate (1990-2000)	5.0%
GDP per capita/year	$416
GDP per capita annual growth rate (1990-2000)	2.2%
Agriculture, GDP	US$1,887 million
as proportion of total GDP	36.3%
Livestock, GDP	US$395 million
as proportion of total GDP	7.6%
Poverty incidence	
Total	36.1%
Urban	21.1%
Rural	40.1%

Source: FAO – AGAL, Livestock Sector Briefs, Cambodia – 2005.

ANNEX 2. HPAI Outbreaks in Poultry in Cambodia, 2004 - 2008

Year	Month	Location		Bird type(s)	No. affected
		Province	District		
2004	Jan	Phnom Penh	Doun Penh	Laying hens	7,500
2004	Mar	Kandal	Kien Svay	Chickens / Ducks / Wild birds	533
2004	Mar	Kandal	Kien Svay	Chickens / Ducks / Wild birds	533
2004	Mar	Kandal	Ta Khmau	Chickens / Ducks / Wild birds	533
2004	Mar	Kampot	Chum Kiri	Chickens / Ducks / Wild birds	533
2004	Mar	Siem Reap	Siem Reap	Chickens / Ducks / Wild birds	533
2004	Mar	Siem Reap	Siem Reap	Chickens / Ducks / Wild birds	533
2004	Mar	Takeo	Bati	Wild birds	533
2004	Mar	Takeo	Daun Keo	Chickens / Ducks / Wild birds	533
2004	Mar	Takeo	Samraong	Chickens / Ducks / Wild birds	533
2004	July	Kampong Cham	Kompong Siem	Native Chickens	10
2004	July	Takeo	Samrong	Native Chickens	13
2004	Sep	Kandal	Kean Svay	Broilers	4,560
2005	Mar	Kandal	Takmao	Backyard Chickens	105
2005	Mar	Kampot	Banteay Meas	Backyard Chickens	28
2006	April	Kampong Speu	Thpong	Chickens	700
2006	April	Kampot	Kampong Bay	Ducks	247
2006	Aug	Prey Veng	Peam Chor	Ducks	1,600
2006	Sept	Kampong Cham	Dambae	Ducks	815
2007	April	Kampong Cham	Ponhea Kreak	Chickens / Ducks	1,086

Source: World Animal Health Information Database (WAHID), OIE, 2008. * For more information see Desvaux *et al.* (2006).

ANNEX 3. HPAI Cases in Humans in Cambodia, 2004 - 2008

Year	Month	Location (Province)	Gender	Age (yrs)	Death
2005	February	Kampot	Female	25	yes
2005	March	Kampot	Male	28	yes
2005	April	Kampot	Female	8	yes
2005	May	Kampot	Female	20	yes
2006	March	Kampong Speu	Female	3	yes
2006	April	Prey Veng	Male	12	yes
2007	April	Kampong Cham	Female	13	yes

Source: World Health Organization (WHO), 2008; http://www.who.int/csr/disease/avian_influenza/country/en/.