



**A Global Strategy for the Progressive Control of Highly
Pathogenic Avian Influenza (HPAI)**

**Food and Agriculture Organization (FAO, Rome)
World Organisation for Animal Health (OIE, Paris)
in collaboration with
World Health Organization (WHO, Geneva)**

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AGAH	Animal Health Service of FAO
AGID	agar gel immunodiffusion
ADB	Asian Development Bank
AI	avian influenza
APAARI	Asia Pacific Association for Agriculture Research Institutes
APHCA	Animal Production and Health Commission for Asia and the Pacific
ARIs	advanced research institutions
ASEAN	Association of Southeast Asian Nations
ASEAN+3	Association of Southeast Asian Nations plus PR China, Japan and Republic of Korea
BSE	bovine spongiform encephalopathy
CSF	classical swine fever (also known as hog cholera)
DIVA	differentiation of infected from vaccinated animals
DPR	Democratic People's Republic
EA	East Asia
ECTAD	Emergency Centre for Transboundary Animal Diseases
ELISA	enzyme-linked immunosorbent assay
EMPRES	emergency prevention system
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GF	global framework
GF-TADs	global framework for progressive control of transboundary animal diseases
GLEWS	global early warning systems
GREP	Global Rinderpest Eradication Programme
HPAI	highly pathogenic avian influenza
JSDF	Japan Social Development Fund
FMD	foot-and-mouth disease
IAEA	International Atomic Energy Agency
IDA	International Development Association
LPAI	Low pathogenic avian influenza
NARES	national agricultural research and extension systems
NGO	non-governmental organization
OFFLU	OIE/FAO Network for avian influenza expertise
OIE	World Organisation for Animal Health (Office International des Épizooties)
PCR	polymerase chain reaction
PDR	People's Democratic Republic
PPE	personal protective equipment
PR China	People's Republic of China
RAP	Regional Office for Asia and the Pacific
RT-PCR	reverse transcriptase polymerase chain reaction
SA	South Asia
SAARC	South Asian Association for Regional Cooperation
SADC	Southern African Development Council
SAR	Special Administrative Region
SARS	severe acute respiratory syndrome
SEA	Southeast Asia
TADs	transboundary animal diseases
TCP	technical cooperation project
UK	United Kingdom
UMO	United Maghreb Organization
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization
WTO	World Trade Organization

FOREWORD

This document, entitled *Global Strategy for the Progressive Control of Highly Pathogenic Avian Influenza* was produced in response to the recommendation made during the 2nd FAO/OIE Regional Meeting on Avian Influenza Control in Asia (23-25 February 2005) held in Ho Chi Minh City, Viet Nam. The recommendation that ‘a master coordination plan be prepared with a global vision defining the road map and time frames for the short, medium and long term priority activities, to be endorsed and supported by individual countries and regional organizations’ was very much stimulated by the worsening crisis of highly pathogenic avian influenza in Southeast Asia causing an increasing number of deaths in human beings. Since the inception of this document in May 2005, avian influenza has progressed from Southeast Asia into Northern China, Mongolia, Kazakhstan, Russia and more recently in Eastern Europe and Turkey, with increasing evidence that the disease is being carried by wild birds migrating along flyways, well beyond the originally infected foci in Southeast and East Asia. The toll in human fatalities and cases has continued to rise, with increasing concerns that the final evolution of the disease, namely human-to-human transfer of HPAI, may trigger a pandemic.

FAO and OIE, within the umbrella of the global framework for the control of transboundary animal diseases (GF-TADs), and in collaboration with WHO, have taken the initiative to develop this strategy paper. The document was prepared in consultation with key partners from Asia following a meeting in the FAO’s Regional Office for Asia and the Pacific, Bangkok between 17 and 18 May 2005, and provides vision and goal towards diminishing the risk of avian influenza to humans and poultry. It also provides approaches and implementation plans for the control of avian influenza. The OIE/FAO International Scientific Conference on Avian Influenza which was held in Paris (France), 7-8 April 2005 provides the scientific basis for the recommendations. The original document represented a first step in the elaboration of a global strategy for the control of highly pathogenic avian influenza. Because of the seriousness of avian influenza in Asia, the original strategy focuses on Southeast Asia, East Asia and South Asia as priority areas for intervention. Due to its spread to other regions the current document expands the strategy beyond these regions to Central Asia, the Middle East, Africa, and Europe.

The strategy paper will be consolidated and complemented by detailed country-specific avian influenza control plans. These plans are currently being prepared for several countries in Southeast Asia, South Asia, Central Asia, parts of Europe and Africa through project formulation missions and exchanges organized by FAO. Such plans are already in place in most member countries of the European Union, in North America, Australia and New Zealand. The strategy paper will serve an important role in assisting the affected and non-affected countries in appreciating the global nature of this transboundary zoonotic disease, improve their disease control programmes and will also be important for the donors considering providing financial assistance.

EXECUTIVE SUMMARY

Why a global strategy for avian influenza?

The continuing outbreaks of highly pathogenic avian influenza (HPAI) in several Southeast Asian countries that began in late 2003 and early 2004 have been disastrous to the poultry industry in the region and have raised serious global public health concerns. Over 150 million domestic poultry have either died or been destroyed and over a hundred people have contracted the infection, of which close to 60 have died since May 2005. Indonesia has been the latest country in which human fatalities and cases have been documented. Economic losses to the Asian poultry sector are estimated at around \$10 billion, but despite control measures the disease continues to spread, causing further economic losses and threatening the livelihood of hundreds of millions of poor livestock farmers, jeopardizing smallholder entrepreneurship and commercial poultry production and seriously impeding regional and international trade and market opportunities.

With the present situation, the potential of the HPAI virus to become transmissible among humans is of serious concern to the global community. If the virus adapts itself to human-to-human transmission, millions of lives may be threatened. The WHO estimates that millions of people could die of HPAI, should a human pandemic occur. Considering the potential for this scenario, the recent Regional Meeting in Ho Chi Minh City, Viet Nam, and the international scientific AI conference in Paris in April 2005 have strongly recommended that a global strategy be developed and implemented to help stem the broad negative impact of the disease. Since then, a regional meeting in Kuala Lumpur was held organized by FAO/OIE and WHO on Avian Influenza and Human Health

FAO and OIE, in collaboration with WHO, have taken the initiative to start a stepwise and consultative process of developing the global strategy. This approach is seen as an integral part of the FAO/OIE Global Framework for the Control of Transboundary Animal Diseases (GF-TADs). The first step in this process has been the development of a strategy for Asia, the region of major HPAI crisis. This step has now been completed through a formal consultative meeting of the key stakeholders in Asia, held in Bangkok in mid-May 2005. The draft document presented here is an evolving document that describes a strategy for HPAI control in and beyond Asia. The document provides a long term vision, goal, approach and implementation plans to control HPAI in Asia with a phased disease control programme. Due to the recent spread of the disease in other regions, the Global Strategy is expanded and similar plans for Central Asia, Africa, Americas and Europe will be developed.

Vision and goal

The long-term vision of the strategy is to minimize the global threat and risk of HPAI in domestic poultry and humans, through progressive control and eradication of HPAI, particularly that caused by H5N1 virus, from terrestrial domestic poultry in Asia. Achieving this goal will diminish the global threat of a human pandemic, stabilize poultry production, enhance a robust regional and international trade in poultry and poultry products, increase human and food safety, and improve the livelihoods of the rural poor.

A phased approach

The global strategy will be implemented over three time frames: immediate to short (1-3 years), short to medium (4-6 years) and medium to long term (7-10 years). During this period the spread of HPAI, mainly of the H5N1 strain, will have been progressively controlled in domestic poultry of all infected countries of Asia, Eastern Europe, and prevented from affecting those other regions and countries not currently infected, but at high risk (Figure 1).

The immediate to short term objective is to reduce the risk to humans by preventing further spread of HPAI in those countries that are currently infected by H5N1. Of these, the focus has been on Viet Nam, Cambodia and Thailand, and is now centered on Indonesia, all of which has had, or is continuing to have human cases of bird flu. The strategy has proposed aggressive control measures for Viet Nam through the deployment of the conventional control methods of culling, biosecurity and movement control, combined with strategic vaccination of domestic poultry and ducks. To this end, evaluation of the feasibility of vaccinating ducks and the study of the epidemiology of the disease have begun, to develop approaches to duck vaccination in Viet Nam and other countries with large duck populations.

Indonesia, which has experienced widespread H5N1-infection since 2004, is now reporting deaths and illness from human avian influenza. The country has adopted a strategy of wide-scale vaccination in the predominantly commercial and backyard poultry sectors with variable success in reducing the incidence of the disease. However, the large scope of the HPAI problem in the vast smallholder poultry sector of this huge country requires a medium to long term strategy to progressively control the disease. Bali, Lombok, South Sulawesi, South Sumatra, Central Kalimantan and all of Java will be targeted by continuing vaccination, deploying OIE approved vaccines with strict post-vaccination monitoring, and stricter biosecurity and stamping out, to progressively confine the disease to defined foci in Java and establishing disease-free compartments and zones. In Indonesia, massive emergency intervention is urgently needed to prevent further spread of the disease, especially in densely populated Java where human fatalities and clinical cases have occurred.

A group of new, non-infected countries at immediate risk, located along the flyways of migratory birds that carry the H5N1 virus, will also require immediate emergency intervention to prevent the disease from taking a hold. These include the densely populated countries in South Asia and others in Central Asia, East Europe and the Caucasus, and North Africa. Countries in Eastern Europe (including Turkey) became newly infected in mid-October 2005. The newly infected countries should return to freedom from infection after stamping out as soon as possible.

While no new cases of HPAI in humans or domestic poultry have recently been reported in Thailand, the question of the vast duck population, acting as a host reservoir for the virus, needs to be urgently addressed to reduce the risk of HPAI in humans and poultry. In Cambodia, active surveillance programmes combined with conventional disease control measures are proposed to wipe out remaining pockets of infection. Given the small scale of HPAI problem, limited to smallholder backyard poultry sector, vaccination in Cambodia is not considered an option. A similar approach is proposed for neighbouring, landlocked Lao PDR, where the scale of the problem is even smaller. Eradicating the disease from these two countries will create a natural land barrier, limiting the chance of spreading HPAI between Thailand and Viet Nam. In Pakistan, renewed outbreaks of H7 virus strains continue to occur, despite vaccination and biosecurity. In Central Russia and Northwestern Mongolia die offs of wild birds have occurred, some with transmission and deaths of domestic poultry.

Over the medium to long term (7-10 years), with the disease localized in foci in Viet Nam, Southern PR China and the island of Java, and contained or prevented in countries beyond Asia, a more focused approach to HPAI control can be mounted to progressively eradicate the disease from the remaining compartments of infected domestic terrestrial poultry in the region. The great, uncertain factor that is now hampering this approach is the emergence of

HPAI-borne disease transmission over great distances, carried by migratory birds. The medium-to-long-term strategy will consider all control measures, including vaccination, zoning and compartmentalization as defined in the OIE Terrestrial Animal Health Code. For the long term success of this strategy, restructuring of the poultry sectors in the region will need to be seriously considered. Much investigative work is required to better understand the transmission dynamics of migratory carrier birds, and ways to prevent the introduction of avian influenza through wild bird populations.

Pakistan is infected with HPAI caused by H7 and H9 strains, and the disease remains a veterinary problem. A medium to long term strategy, deploying good quality vaccines and consistent vaccination, post-vaccination monitoring combined with the use of conventional HPAI control measures will be necessary given the extensive nature of the country's farming systems and the lack of adequate disease surveillance and control infrastructure.

H5N1 has expanded in a north-westerly direction and outbreaks occurred in Russia, Kazakhstan, Turkey, Romania and cases in wild birds were reported in Mongolia. These recent outbreaks may be suggestive of the role of wild birds in the epidemiology of HPAI. To prevent the threat of HPAI from spreading to avian influenza-free countries, the long-term strategy supports the development of pro-active surveillance programmes and emergency preparedness plans for non-infected, at-risk countries in Southeast Asia, South Asia and the new countries at risk in Central Asia, Eastern Europe and the Caucasus, the Middle East and Africa. The application of OIE standards relating to the international trade of poultry and poultry products will further assist in preventing the spread of HPAI virus across continents. The Global Strategy now focuses not only on South, East and Southeast Asia, but has been expanded to other regions in Asia, and large parts of Europe and Africa.

Capacity building

Inadequate capacity in many countries is the principal limiting factor for effectively and quickly stamping out and controlling infectious diseases. Thus the strategy suggests building a strong and sustainable human and physical resource capacity, especially in countries at immediate risk, to respond in a more effective and timely manner in stamping out, linked to a compensation policy, not only for HPAI outbreaks but also other newly-emerging infectious zoonotic and transboundary animal diseases (TADs). Capacity building will be wide ranging and include all aspects of disease control as well as policy development and socio-economic impact analysis.

Strategic research

The global strategy recognizes that the dynamics of the current rapid spread and persistence of HPAI remain unclear. Therefore, the strategy will facilitate strategic research to investigate the epidemiology of avian influenza, evaluate the efficacy of vaccines in domestic ducks to reduce virus shedding in domestic duck reservoirs, of HPAI transmission dynamics in migratory birds, and work in close collaboration with regional and international advanced research institutions (ARIs) and wildlife organizations, to promote the development of improved vaccines and rapid diagnostic tests. Risk analysis of various poultry production systems and their marketing chains will be carried out to better target effective disease control. In the long term, given the changing nature of the AI viruses, the role of the complex interactions between the avian influenza virus, the hosts and the changing environment needs to be better understood. This should help in developing pro-active measures, such as readjustment of poultry industry in better tackling the emergence of new influenza viruses.

Implementation

The global strategy will be implemented at the national, regional and international levels. At the national level, well-defined country specific projects will be formulated, such as has been done for Pakistan, Indonesia, Lao DPR and Cambodia.

Well defined regional projects are being formulated for Central Asia, East Europe and the Caucasus, the Middle East and North, Eastern and West Africa. At present, technical cooperation projects have been prepared to provide immediate assistance to those countries in most urgent need. These interventions will be underpinned by the formation of sub-regional HPAI support units, located in Southeast, East and South Asia (SA), Africa, Eastern Europe, Middle East and Central Asia. Through these Units, sub-regional disease diagnosis and surveillance and socio-economic and policy analysis networks will be established. These subregional networks will provide the lead in the development of harmonized technical standards and regional policies related to the management of live animal movement, compensation plans, capacity building, disease reporting requirements and long term planning to restructure poultry sectors.

At the international level, coordination of the national programmes and subregional networks will be under the umbrella of GF-TADs (global framework for the control of transboundary animal diseases), a joint FAO/OIE initiative. The international coordination will provide technical backstopping to the subregional networks and national programmes, promote international cooperation, and mobilize and coordinate resources for HPAI control. The regional coordination will be supported by the GF-TADS regional steering committees and by FAO's Regional Office for Asia and the Pacific (FAORAP, Bangkok), and in Regional/Subregional FAO Offices in Budapest, Nairobi, Bamako, Tehran, Cairo and corresponding OIE regional offices in Tokyo, Beirut, Buenos Aires, Bamako and Sofia.

The global HPAI control and eradication programme will draw on the experience of other countries, and will be guided by FAO's experience of the Global Rinderpest Eradication Campaign (GREP) in successfully controlling and eradicating rinderpest in Asia.

Partners

The main partners in implementation of the strategy will be the infected and non-infected 'at risk countries', the new countries at immediate risk, and the regional organisations (e.g. ASEAN and SAARC, Economic Cooperation Organization (ECO), Arab Maghreb Union (AMU), AU-IBAR (African Union Interafrican Bureau for Animal Resources) and Southern Africa Development Community (SADC), all of which are committed to controlling transboundary animal and zoonotic diseases (see Appendix 9 for details). Given the zoonotic nature of the HPAI, and the complex interface between farming systems, livestock trade, food safety and public health, a strong international partnership among FAO, OIE and WHO will be continued. This partnership will promote joint epidemiological studies, harmonise contingency plans, and promote public awareness and share virus strains and other technical information. A number of other partners will be involved, important among these would be the private sector, NGOs and regional national agriculture extensions systems (NARES), and selected wildlife organizations.

Resources

The implementation of the strategy will require over \$140 million for the next three years to support the national, regional and international HPAI control programmes as outlined above. Further details are presented in Table 4.

1. INTRODUCTION AND BACKGROUND

1.1 Emerging transboundary zoonotic diseases pose a serious and continual threat to global economy and public health

Transboundary animal diseases (TADs), including those that are zoonotic, continue to give rise to widespread and important economic and social impacts in the increasingly globalizing world. With a large and growing volume of regional and international trade in livestock and livestock products and the rapid movement of large numbers of people across continents through air travel, several emerging infectious zoonotic diseases are spreading widely and quickly over large geographical regions. These have a wide-ranging impact on the livelihoods of farmers, regional and international trade, food safety, public health and international travel and tourism.

While the economic losses from TADs, such as foot and mouth disease (FMD) and classical swine fever (CSF) in Europe have been well documented, it is the newly emerging zoonotic diseases that are causing increasing world-wide concern. The bovine spongiform encephalopathy (BSE; mad cow disease) crisis in Europe provides a disturbing example of a serious emerging zoonotic disease moving into new areas by means of trade flows of contaminated meat and bone meal. In 1999, a Nipah virus outbreak in Malaysia destroyed the swine industry while simultaneously creating massive public panic resulting from human fatalities. The 2003 Severe Acute Respiratory Syndrome (SARS) outbreak infected several hundred people in large parts of South and Southeast Asia and Canada. International travel and tourism were severely curtailed by the outbreak of SARS in Asia. The disease took over a year to be brought under control, costing the sub-region over \$30 million. Over the last several decades an average of one newly emerging disease per year has been identified, of which 75% have been of the zoonotic type. Their transboundary nature highlights that no country can count itself exempt from such diseases.

The effective, sustained control of such animal diseases, leading to their eradication where feasible or at least to their exclusion from large livestock producing zones, is a prerequisite to meet the future global demand for safe and wholesome livestock products. It is also becoming increasingly apparent that many reservoirs of infection can be found in the developing world, in particular amongst the lower-income livestock farming segments; i.e. among the rural poor. This poses serious risks to the livestock sector, which is faced with a rapidly expanding demand for dietary animal protein in many developing countries, driven by growing urbanisation, increasing disposable income, and shifts from starch-based to protein-based foods. There are substantial opportunities for economic growth, particular in rural areas, to be fuelled by this process, widely termed “Livestock Revolution”. However, these opportunities are being threatened by emerging transboundary animal diseases, many of which are zoonotic in nature. Therefore the control of such trade-limiting diseases is becoming ever more important.

1.2 HPAI is the most recently emerged transboundary zoonotic disease

The experience of the 2003 SARS outbreak in Asia has clearly underlined the need to strengthen capacity in disease surveillance, improve transparency in reporting, and improve regional collaboration and cooperation. Many Southeast Asian countries in the region found themselves unable to control the rapid spread of avian influenza that emerged in early 2004. The rapid spread of HPAI across Southeast Asia, which caused high mortality in its previously unexposed, highly susceptible commercial and smallholder poultry populations, came as a shock as it was realized that prevailing disease information systems and the veterinary capacity to deal with the outbreaks were far from adequate to handle the scope of the emer-

gency. Retrospective analysis clearly indicates that the disease was already present and had been spreading undetected in parts of Southeast Asia since mid to late 2003. Avian influenza once present only in PR China and Hong Kong, has now become a major problem for all of Southeast and East Asia. The recent introduction of HPAI in north-westerly direction into Asia, Middle East and Europe has made even clearer the global impact of this most recently emerged transboundary zoonotic disease. With the possible role wild birds play in the epidemiology of HPAI, large regions of Asia, Middle East, Europe and Africa have become at immediately risk. HPAI now poses a serious threat not only to the Southeast Asian sub-region but also to the rest of the world.

The three FAO/OIE regional meetings on HPAI, (Bangkok, February 2004 and in Ho Chi Minh City, February 2005; Kuala Lumpur, 2005) held in collaboration with WHO and the participating countries, as well as the first meetings of the GF-TADs Steering Committees for Asia (Tokyo, March 2005) and Europe (Paris October 2005), acknowledged and appreciated the prompt response by FAO and the international community in mobilizing emergency funds and technical support to tackle the regional crisis. While significant progress has been made, these meetings also recognized the importance of marshaling more resources and targeted efforts to curtail the spread of the disease. The dynamics of the transmission and spread of HPAI remain poorly understood and regional veterinary capacity inadequately equipped to carry out the necessary comprehensive active surveillance and field mobilization programmes to implement more effective and timely emergency preparedness, stamping out, biosecurity, vaccination and other control measures. HPAI has significant and growing Public Goods implications that affect the world beyond Southeast Asia. Strong political commitment at the national and international levels will be required to invest more resources in all aspects of disease control. Among a number of recommendations emerging from the Ho Chi Minh City meeting, the most important and significant one was the call for the development of a global strategy linked to comprehensive disease control plans, supported by substantial financial resources to tackle the HPAI problem country by country in a coordinated manner. In response, FAO and OIE, under the framework of GF-TADs (Appendix 1) and in collaboration with WHO, have taken the initiative to develop this global strategy for HPAI control. More recently, wild migratory birds have been considered to play an important role in disseminating the disease in new regions than South and East Asia. According to this new situation, the Global Strategy has been complemented accordingly and other modifications could come as the evolution of the epizootic requires it.

2. WHY A GLOBAL STRATEGY?

The rationale for developing and implementing a global strategy for the control of HPAI is multiple. Key reasons include:

- **HPAI is a highly infectious and dynamically evolving disease** that spreads rapidly and widely across countries and continents.
- **HPAI is often zoonotic and transboundary in nature**, with the potential to cause a global human pandemic.
- **HPAI has emerged and spread rapidly** as a consequence of globalized markets.
- **HPAI maybe transported widely and quickly by migratory birds**, along flyways and in resting or nesting areas.
- **HPAI impacts on the livelihoods of millions of people**, especially the rural poor.
- **HPAI threatens regional and international trade** and places the global poultry industry in the developed and developing worlds at risk.

- **HPAI results from low pathogenic avian influenza (LPAI)**, which is present in wild birds in many parts of the world. All countries in the world are at risk of being infected unexpectedly.
- **HPAI outbreaks are beyond the scope and resources** of a single country or region to control.
- **Protecting global human health and well-being** is a responsibility of the international community.

Some of the above listed reasons are further elaborated below.

2.1 Avian Influenza virus is constantly evolving with unpredictable results

The HPAI viruses are of particular concern because they are very labile and undergo constant genetic change due to mutations and gene reassortment, resulting in ‘antigenic shifts’ that can have unpredictable results (see Appendix 2). In fact, the generation of H5, H7 and H9 subtypes in Asia and the evolution of the Z genotype of H5N1, which is currently causing much concern to human health, were the result of such genetic changes. The widespread circulation of the H5N1 in domestic ducks and terrestrial poultry has resulted into the selection of more aggressive Z genotype with a Z⁺ strain infective to humans and spreading to Thailand, Viet Nam and more recently to Cambodia. While this is a clear and present threat to global poultry industry and public health, the constant and rapid evolution of the virus necessitates a global approach to controlling the disease.

The role of wildlife in the spread of avian influenza is still not clearly understood, but seems to be increasingly important. While the gene pool of the avian influenza viruses is relatively benign in its natural wildlife population hosts, it can evolve rapidly after infecting and adapting to domestic poultry. Available evidence points towards factors such as the changing population size and structure of the poultry industry, the expansion of virus circulation from its traditional host range to domestic ducks and terrestrial poultry, its transmission from migratory wild birds to domestic poultry, and its wide geographical spread through trade in live-birds being the main reasons for concern.

2.2 The risk of a human pandemic

The H5N1 strain currently affecting several Asian countries has also proven highly fatal to humans. It is impossible to predict when the virus might reach an adaptive level to allow for human-to-human transmission, but as the virus progresses to an endemic state, its changing genetic composition increases the likelihood for it to become transmissible to humans. The second such transmission phase, poultry-to-humans, recently evolved in Indonesia. WHO estimates that should a pandemic occur, millions of people could die of the disease.

2.3 The livelihoods of the rural poor are threatened

Despite remarkable progress in addressing extreme hunger and poverty, the number of the world’s poor remains high. Some 80% of the poor live in rural areas and the vast majority is dependent on agriculture for its livelihood. For poor households depending for their livelihood on poultry, HPAI has meant the loss of income and food security. A 2004 FAO survey found that in seriously affected areas of Indonesia, more than 20% of the permanent industrial and commercial farm workers lost their jobs, the demand for day-old chicks decreased by more than 40%, and the demand for poultry feed was reduced by up to 45%. In Viet Nam and Cambodia, the prices of non-poultry meats rose up to 30% when live-bird markets were disrupted by HPAI and remained high even after the poultry markets recovered, taking the purchase of poultry meat out of reach for low income consumers.

In Asia, many countries presently infected with HPAI H5N1 (such as Cambodia, Indonesia, Lao PDR, Thailand, Viet Nam, China) show significant differences in living standards, economic prospects, per capita income and population size (Table 1). Lao PDR and Cambodia have the lowest per capita incomes in the region, whereas Thailand belongs to the group of newly industrializing countries. The vast majority of the poor lives in rural areas and depends on mixed farming systems that include some level of poultry production. The total number of poor people in the currently affected countries dependent on poultry is estimated at between 136 -210 million (Table 2).

2.4 Expansion of avian influenza to regions beyond Southeast and East Asia

There is a growing risk that HPAI subtype H5N1 may be carried along migratory flyways of wild birds areas beyond the originally infected regions. In Central Asia and Eastern Europe, Kazakhstan, Mongolia, Russia, Turkey, Romania and Croatia have recently reported H5N1 outbreaks, some in domestic poultry, others in wild birds. The complex overlapping of major flyways and the lack of information on migratory species potentially involved in AI disease spread makes the straightforward association of wild bird transmission to domestic poultry difficult to ascertain. It is plausible that HPAI H5N1 virus could spread further into Europe, the Middle East and Africa in the foreseeable future. This development puts the new regions of Central Asia, Eastern Europe, Middle East, the Caucasus, and Africa at increasing risk.

2.5 Non-infected but at risk countries in East, South and Southeast Asia

While HPAI has spread rapidly through Southeast Asia, it is important to note that several non-infected countries in the region have become at immediate risk. These include, in Southeast Asia, Brunei, Myanmar, Papua New Guinea, Philippines, Singapore and Timor Leste; in South Asia Bangladesh, Bhutan, India, Nepal and Sri Lanka; and in East Asia, Japan, Republic of Korea and People's Democratic Republic of Korea (These East Asian countries were infected before, but eradicated the disease). Many of these countries have rapidly expanding poultry industries, combined with large and dense human populations. In the poor, non-infected countries of these regions with limited veterinary infrastructure, HPAI outbreaks would be devastating, affecting over 400 million resource poor farmers.

2.6 Newly infected countries in Central Asia, East Europe

Kazakhstan, Mongolia, Siberia in central Russia, Turkey and Romania became the first countries to become infected the by avian influenza beyond its original Southeast Asian source. In the case of Siberia, Kazakhstan Mongolia, Turkey and Romania direct or indirect transmission by wild birds is suspected or was proven to be involved. Where domestic poultry at risk or infected, such as in Turkey and Romania, stamping out and biosecurity was implemented. This group of countries has diverse poultry subsectors, ranging from semi-intensive (Turkey, Romania) to rural (Kazakhstan, Siberia).

2.7 Globalized markets have caused HPAI to spread rapidly

The conditions for the emergence and local spread of HPAI have been exacerbated by the intensification and concentration of livestock production in areas of high-density human populations. The danger of international spread of HPAI has increased by the dynamics of regional and international trade and the movement of people. The possible role of wild migratory birds is not yet fully elucidated. These conditions apply not only to HPAI but also to other trans-boundary animal diseases. A global approach to avian influenza, therefore, will have relevance to strategic control of other livestock diseases, including zoonoses.

2.8 Economic impact and poultry trade are in jeopardy

Over 150 million poultry were destroyed as the result of the 2003 and 2004 HPAI outbreaks in Asia. The direct and indirect economic impact, while still being evaluated, has reached billions of dollars. Trade in poultry at the domestic, regional and international levels has been severely affected. The total losses in GDP accruing from the damaged poultry sector in Asia amounted to \$10 billion. If the direct health risk impact from avian influenza in birds is added to the overall negative impact problem on livestock and the drop in tourism, economic losses would be considerably higher, even if the human incidence of avian influenza were to remain limited. Details of economic impact in individual countries are given in Appendix 3.

3. THE STRATEGY

The long-term strategy envisions a world with minimum threat and risk of highly pathogenic avian influenza in humans and in domestic poultry. Implementation of the strategy will significantly reduce the risks of human pandemic.

3.1 Goal

The overall goal of the strategy is to progressively control and eradicate HPAI from the domestic poultry sector in Asia and Europe, and prevent further introduction of HPAI in non-infected countries, thereby minimizing the global threat of a human pandemic, promoting viable poultry production, enhancing robust regional and international trade in poultry and poultry products, increasing safety of food and feeds, and improving the livelihoods of all poultry sector stakeholders, and especially the rural poor.

3.2 Guiding principles

The following broad guiding principles are used in developing a global vision for the control of HPAI:

- **Commitment**
The control and eradication and prevention of HPAI from the domestic poultry sector are considered a global public good function, requiring strong national, regional and international commitment.
- **Multidisciplinary**
HPAI control programmes require a multidisciplinary approach to integrate technical, social, political, policy and regulatory issues in addressing a complex problem.
- **Broad Collaboration**
The global strategy is inclusive and will use a wide range of collaborators in addressing the problem.
- **Adaptable and knowledge based**
The strategy will continually adjust itself to new information and technologies, respond to changing environments and new knowledge.
- **Pro-Poor**
The strategy will take into account the interests of the livelihoods of the rural poor who are the most vulnerable.
- **Economically sustainable.**
Encouraging equitable poultry sector growth conditions through a combination of activities that will benefit the poor as well as support market based economic growth.

3.3 Approach

The strategy will be based on a sound epidemiological approach to control HPAI and on optimal preparedness to prevent further spreading of HPAI in Asia and the rest of the world, recognizing that complete eradication will not be possible due to its presence in wild bird res-

ervoirs. This approach will take into consideration the range of epidemiological scenarios that exist in different poultry production systems in the affected countries in Asia. The epidemiological scenarios range from a high incidence of disease with frequent outbreaks in poultry and humans, to a low frequency disease incidence with variable flock immunity, to sporadic disease outbreaks, to free of the disease, but at risk. A combination of appropriate disease control options (*FAO Position paper: Recommendations on the prevention, control and eradication of Highly Pathogenic Avian Influenza (HPAI) in Asia, September 2004*) which received the approval and support of OIE, is available to control HPAI, depending on the stage different countries and farming systems have reached along this continuum of variable disease states (see figure 1). Current disease scenarios can be grouped under the following six categories:

1. High disease incidence:

- high virus load
- disease spreading in new areas and possibly new human infections
- little or no immunity in terrestrial poultry populations
- carrier duck populations are a source of infection

2. Medium to low disease incidence:

- high virus load
- the disease not spreading to new areas
- no human infections
- disease endemic in smallholder poultry sector
- variable flock immunity depending on vaccination efficacy and coverage
- carrier duck reservoirs are a source of infection
- wild bird transmission thought to be important

3. Low level of disease incidence:

- low virus load
- highly susceptible poultry population
- carrier ducks probably not important
- low poultry density
- wild bird transmission might play a role

4. Freedom from infection in certain compartments and zones:

- low virus load in infected parts
- highly susceptible poultry population
- disease incidence present in smallholder sector in certain areas
- commercial poultry farms are HPAI-free
- carrier duck population might be a source of infection

5. Freedom from infection after stamping out:

- highly susceptible, clean population of domestic poultry
- at risk if disease re-introduced.
- duck reservoirs not important

6. Freedom from infection without history of HPAI infection:

- highly susceptible, clean population of domestic population
- high risk of HPAI in poultry and humans if disease introduced

- ducks reservoirs not important
- along migratory flyways

All countries in the ‘freedom from infection categories’ (5 and 6) are at risk. However, countries with weak disease control and prevention capacity are at a higher risk than those that have stronger capacity.

The objective of this approach is to progressively shift the majority of infected countries towards disease categories 4 (freedom from infection in defined compartments) and 5, while ensuring that the countries free of disease (categories 5 and 6) continue to remain free from HPAI (re)incursion and when countries get infected the disease will be controlled as soon as possible, without the change of the appearance of new endemic areas. This would allow countries to conduct unrestricted and safe trade in poultry and poultry products in local, regional and international markets. Freedom from HPAI infection according to the six defined disease categories outlined above is a realistic, and an achievable goal for many countries.

To fulfill this objective, a stepwise and phased disease control programme with time-frames ranging from immediate to short term (1-3 years), short to medium term (4-6 years), and medium to long term (7-10 years) for the affected countries is proposed and to strengthen the prevention and preparedness capacity in countries at risk in the short term. Given the great diversity of HPAI conditions in the target countries, these time frames will vary from country to country and will depend on a number of factors, such as the current disease situation, disease control options currently being undertaken, available disease control capacity, and in the long term, ability to maintain sustained vigilance and emergency preparedness. Given the great diversity in veterinary infrastructures in the world, the necessarily effort for prevention and preparedness will differ per region and country.

The geographical focus of the strategy will include all infected (see Figure 2) and non-infected at immediate risk countries in Asia, Middle East, Europe and Africa. The H5N1-infected countries include Cambodia, PR China, Indonesia, Lao PDR, Thailand, Viet Nam in Southeast Asia and Mongolia, Kazakhstan, Russia, Turkey and Romania. The H7/H9 infected country includes Pakistan, the only country infected with HPAI other than H5.

The non-infected at immediate risk group of countries includes those free of infection after having stamped out the disease (currently including DPR Korea, Hong Kong SAR, Japan, Malaysia, and Republic of Korea) and those that have never been infected (Brunei, Myanmar, Papua New Guinea, Singapore, Timor Leste and Philippines) in Southeast Asia and (Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka) in South Asia, all in close proximity to currently endemic areas in Asia.

The non-infected new countries at risk include the other regions of the world, especially those along migration routes of wild water birds flying across densely populated areas in Central Asia, Southern Asia, Middle East, Africa and Europe.

This overall phasing of control and prevention strategies will require progressive strengthening of capacity in disease surveillance (including wild birds) and emergency preparedness, as the resources expended on disease control

3.3.1 Infected countries in South, East and Southeast Asia

Several Southeast Asian countries are currently infected with the H5N1 strain. While the general ecology of virus and host is similar in the Mekong countries, their disease patterns and

epidemiology differ greatly. Therefore the strategy proposes different approaches, tailored to each country. The broad strategy proposed for each is presented below. More specific details will be provided following country-specific project formulation missions currently being organised by FAO.

3.3.1.1 Vietnam (H5N1)

Vietnam has high-density poultry areas infected with H5N1, combined with human cases and fatalities. The disease is mainly concentrated within two areas, in the northern Red River valley and the southern Mekong delta, where large carrier duck populations act as huge reservoirs for infection. Vietnam is currently embarked on a national vaccination campaign.

In the short-to-immediate term, the objective in Vietnam will be to curtail the spread of H5N1 HPAI to humans by means of enhancing country-wide, risk-based, targeted surveillance programme, aggressively stamping out new outbreaks, in combination with the application of strict biosecurity measures, movement control and strategic use of vaccination in densely populated terrestrial poultry areas and in ducks. Given the limited knowledge of the virus transmission dynamics and the efficacy of vaccinating ducks, epidemiological studies and vaccine efficacy evaluation is of high priority in Viet Nam. Applying these control measures will, in the medium- to long-term, push the disease into small, defined foci.

It is expected that Viet Nam would have significantly reduced disease incidence in poultry and humans by achieving a high level of flock immunity through vaccination within 4-6 years. Reaching this stage would present the opportunity for setting up disease-free compartments from which unrestricted, safe trade in poultry products could be achieved in 7-10 years time (category 4).

3.3.1.2 Cambodia and Lao PDR (H5N1)

Both countries have had relatively limited H5N1 HPAI outbreaks, including some human cases and fatalities in Cambodia, mainly believed to be due to the low density of their poultry populations and predominantly backyard poultry sector. The infective virus load in the environment appears to be low. However, Cambodia has recently reported human cases of avian influenza. Given the diffuse nature of the poultry population, surveillance has not determined the exact spread of the disease. Ducks do not seem to be a major problem in either of these two countries.

In the immediate to short term, active, risk-based surveillance programmes will be implemented and conventional approach of stamping out; biosecurity and movement control will be imposed on infected areas to progressively contain the disease in increasingly smaller foci in terrestrial poultry. In the medium to long term, Cambodia and Lao DPR will strengthen their surveillance with improved veterinary capacity, enhancing their ability to maintain disease-free zones on a sustainable basis.

Cambodia and Lao PDR are likely to be able to achieve disease-free status in large parts of the country (category 4), providing a significant land barrier between parts of Viet Nam and Thailand within 1-3 years time.

3.3.1.3 Thailand (H5N1)

Thailand's poultry sector has been affected by H5N1, and several human cases and fatalities have occurred. With increasingly stronger surveillance programmes and a large, export-oriented commercial poultry industry, Thailand has, to a large extent, been able to eradicate

the disease from commercial terrestrial poultry. The disease now appears to be restricted to the smallholder sector in certain areas. However, carrier duck reservoirs remain a constant threat to re-infection.

In the immediate to short term, the approach will be to build on Thailand's success in establishing disease-free compartments, to aggressively identify foci of infections in the smallholder farming system, and stamp out the disease with conventional disease control options. Vaccination may be considered in the domestic carrier ducks population as a means to reduce 'spill over' risk to the increasingly susceptible terrestrial poultry population. This approach will enable Thailand to establish disease free compartments and to re-establish its lucrative export market (the world's fourth largest) within 1-3 years time.

3.3.1.4 PR China (H5N1)

China experienced HPAI infection well before the current crisis began in late 2003 and early 2004. It has not reported any human cases, but has a vast duck population that acts as a source of infection for terrestrial poultry. China is vaccinating domestic poultry and ducks in high-risk areas, using locally produced inactivated vaccines, as the principal method of controlling the disease, given the widespread nature of HPAI in the country. Vaccine efficacy in ducks appears to be good, with a reportedly significant reduction in virus shedding.

Within the immediate to medium-term (1-6 years) the current disease control strategies applied will be improved and consolidated. This will involve proactive, risk-based surveillance, stamping out, application of biosecurity measures, and strategic vaccination with well-defined good quality vaccines. Vaccination of terrestrial poultry will be linked with a well-structured post-vaccination surveillance programme to provide better information on the disease dynamics and the impact of increasing flock immunity in domestic poultry. Further field studies will be carried out to determine the impact of duck vaccination on the level and duration of virus shedding under field conditions.

In the medium- to long-term (4-6 years) the disease will be pushed back into well-defined areas. This will provide an opportunity for the country to establish disease free compartments to trade safely in poultry products (category 4) within 7-10 years.

3.3.1.5 Indonesia (H5N1)

The disease is widely spread across Indonesia, especially in the smallholder sector, and human cases and fatalities have been reported. Vaccination was introduced soon after the rapid spread of the disease to reduce massive losses. A number of locally produced and imported vaccines are being used. Vaccination appears to have reduced the high mortality experienced in early outbreaks, but the exact impact of vaccination has been difficult to determine due to limited post-vaccination monitoring. Indonesia also harbours a large duck population, raised under different farming systems. The role of ducks in the epidemiology of the disease is not fully understood. Within the immediate to medium-term, Indonesia will be targeting systematically in the same manner as PR China. Vaccination of ducks may be considered but will depend on further characterization of this virus reservoir and its role in disease transmission. In the medium- to long-term, the disease will be pushed into defined foci in Java.

It is expected that, over a period of 1-6 years, most of the islands (Bali, Kalimantan, Sulawesi, and Sumatra) will be free of HPAI and the disease will be confined to well defined foci on the island of Java (category 4). This will enable Indonesia to establish disease free compartments to trade safely in poultry products (category 4) within 7-10 years.

3.3.1.6 Pakistan (H7 and H9)

Avian influenza in Pakistan is mainly a veterinary problem due to HPAI, caused by H7 and H9 strains, since 1995. No human cases have been reported. However, H7 and H9 strains have been shown to present potential risks to humans as was shown in the Netherlands during the 2003 outbreaks. Given the proximity of Pakistan to other densely populated South Asian countries, the strategy also proposes assistance to controlling the disease using a medium- to long-term time frame, given the extensive nature of the farming systems and the lack of adequate disease surveillance and control infrastructure. Pakistan is expected to have HPAI-free domestic poultry compartments within 7-10 years

3.3.1.7 Non-infected countries in Southeast, South and East Asia

These countries can be classified in two main groups; countries that have experienced HPAI but were able to stamp out the infection, and countries that have never been infected. Both groups remain at risk. Of the former group, countries such as Japan, Hong Kong SAR, Malaysia, Republic of Korea have been able to stamp out the disease successfully because of strong veterinary services, good surveillance programmes and adequate resources.

Of the group of countries that have never been infected, several countries (Brunei and Singapore) have adequate resources to stamp out the disease, while most others lack adequate human, physical and financial resources to deal with potential HPAI outbreaks. These countries include, in Southeast Asia Myanmar, Papua New Guinea, Philippines and Timor Leste, in East Asia DPR Korea, and South Asia Bangladesh, Bhutan, Maldives, Nepal, and Sri Lanka. In order for these countries to prevent incursion and ensure that the disease does not get established, enhanced veterinary capacity, better surveillance programmes, well developed emergency preparedness plans and sufficient resources and expertise are needed to stamp out infection, should it occur. Therefore in the short to medium term the strategy will focus on these aspects. This entire phased approach will require increasingly strong capacity in risk-based disease surveillance and emergency preparedness, as disease control progresses from categories 1, 2 and 3 above to categories 4 and 5.

3.3.2 Newly infected countries in Asia and Europe

Since summer 2005 H5N1 has expanded in a north-westerly direction. Outbreaks of HPAI have resulted in deaths and culling of domestic poultry in Russia, Kazakhstan, Turkey, Romania and cases in wild birds were reported in Mongolia and Croatia. These recent outbreaks of HPAI are highly suggestive of the role of wild birds in the epidemiology of HPAI. The strategy focus on bringing the countries in the category 5, freedom from infection after stamping out.

3.3.2.1 East Europe and Turkey

Romania and Turkey. Deaths due to H5N1 were reported in domestic turkeys in Turkey, and in whooping swans in Romania. These cases, reported in mid-October 2005, represent the H5N1 infections closest to Western Europe since their spread began from Southeast Asia.

3.3.2.2 Central Asia

Russia. The large majority of AI outbreaks were detected in village poultry; only two outbreaks were suspected in commercial poultry holdings. Deaths of wild birds were reported in all infected areas. Russia applied stamping out and movement restriction to control the disease. No vaccination was used. Until the date the disease is not totally under control in all affected areas. In assessing the local epidemiological situation the introduction of HPAI H5N1

could not be directly explained by the movement of poultry and poultry products. Conclusive evidence for the involvement of wild birds in the introduction of H5N1 virus does not exist, although several factors strongly indicate a potential role for wild birds in the spread of infection. Active surveillance and monitoring in wild birds have to be developed, and early reporting of unusual mortality in any species is important. Also a program of active surveillance should be set up in domestic poultry (backyard and commercial) for early detection in domestic poultry.

Kazakhstan. HPAI outbreaks have occurred in domestic poultry, but not in large commercial farms. Several wild birds were found dead. Control and preventive measures were being taken and border controls have been strengthened. The outbreaks of HPAI in Kazakhstan have been eradicated effectively. Measures to keep commercial poultry confined and backyard poultry enclosed have proven effective and should be continued over the coming years. The present eradication strategy for infections in back yard flocks is recommended, as well as to intensify the monitoring of wild water fowl for HPAI.

3.3.2.1 East Asia

Mongolia. Deaths of migratory birds were reported in several lakes in Mongolia. Till now no cases have been found in domestic poultry. Mongolia does not have a large and dense poultry population. The focus to prevent HPAI outbreaks in domestic poultry should be on intense surveillance.

To prevent further spreading of H5N1 and keep non-infected countries free of infection, the strategy focuses on increasing emergency preparedness. This can be achieved by strengthening national capacity with regional networking relating to the following activities: (a) surveillance for early warning of introduction of HPAI virus into domestic poultry and species of wildlife posing a special risk (b) risk analysis relating to such introduction, and (c) contingency planning to facilitate early reaction if needed. Resources should be focused on the reduction of close contacts between humans, domestic poultry and wildlife. Limiting contact with wild birds should therefore be part of any avian influenza control strategy. The different regions will differ greatly in risk, due to difference in veterinary structure, poultry density, poultry structure and the relations to migratory bird routes.

3.3.3 New non-infected countries at risk

3.3.3.1 Central Asian country profiles

This region, as others, is divided into high and low risk, based on the extent to which the poultry sector has developed, their veterinary services infrastructure, and population density. Based on this categorization, countries at high risk include Iran, Pakistan, with the remainder at low risk.

Afghanistan. Over 85 percent of its population is highly dependent on agriculture. Livestock products are a main food staple. Veterinary services are very weak, and the country has few means to control transboundary diseases. A \$3.5 million project to improve food security and household poultry production is presently under implementation.

Iran has the most intensive poultry subsector in Central Asia, together with a well-trained veterinary service. Diagnostic capacity is generally good. The National Veterinary Laboratory in Tehran, together with that in Islamabad, Pakistan, is one of the best in the region and very suitable for regional backstopping.

Tajikistan is the poorest of the Central Asia countries with an estimated 8 percent of people living below the poverty line. About 70 percent of its people depend on agriculture for their

livelihood. The poultry sector is mainly rural, with only three commercial poultry farms in the country. However the poultry sector is growing rapidly, with egg production doubling from 3.5 million to 6.2 million eggs between 2003 and 2004.

Uzbekistan has over 6 percent of its population living in rural areas. Its centrally-controlled government is gradually transforming to avoid a drastic fall in living standards that affected other CIS countries. In 2003, economic reforms were launched in the agriculture sector to promote investment and increase production.

Kyrgyzstan is a significant livestock producer, including poultry. Forty-five percent of its population is employed in agriculture. Veterinary services and public health services are very weak, and in urgent need of restructuring.

Turkmenistan has embarked on national reforms that include food safety and social security. Its veterinary department does not receive a government budget and has to generate its own operating funds from service activities.

Kazakhstan has a substantial livestock sector, including rural and commercial poultry. The Scientific Research Agricultural Institute (SRAI) is well organized, employing up to date technologies and equipment. Kazakhstan is the only Central Asian country with reported H5N1 cases.

Most of these countries have weak veterinary infrastructures and will require donor support to implement biosecurity, emergency preparedness and laboratory or surveillance capacity. Since wild bird transmission appears to play a significant role, investigations and targeted surveillance are of great importance.

3.3.3.2 Middle East

The Middle East Region has a substantial poultry population of over 1 billion, and a human population of over 250 million, of which the vast majority of domesticated poultry comprises chickens. A large proportion of these are commercial poultry, kept under confinement, to which on-farm biosecurity measures can be applied. Informal domestic poultry trade within and among countries in the region may also contribute to the dispersal or spread of HPAI and needs to be assessed and monitored.

3.3.3.3 Eastern Europe and Caucasus region

Human and poultry populations vary greatly, as do their veterinary and human health services infrastructures. Several countries have substantial, vertically integrated commercial poultry industries, whereas many others comprise mostly backyard poultry. Significant numbers of domesticated poultry in the region are free ranging, with the potential of contacting migratory birds. Outbreaks of HPAI have occurred northeast of the region, which is at significant risk of being exposed to avian influenza from birds flying from infected areas. Informal domestic poultry trade within and among countries in the region may also contribute to the dispersal or spread of HPAI and needs to be assessed and monitored. The veterinary systems of the smaller, less resource-rich countries will have more difficulty coping with controlling the disease.

Infected countries requiring emergency assistance with stamping out, public awareness and biosecurity include Turkey and Romania, together with their neighboring countries.

3.3.3.4 Africa

The Eastern Africa Region are host to about 300 million poultry and 287 million people; a nearly one-to-one ratio, with an important rice production. It is to be emphasized that correlation between the rice production and the outbreak of AI has been observed in Asia, the linking factor apparently being the keeping of free-ranging ducks in 'traveling groups' in these rice

fields. An estimated 60 to 70 percent of poultry in the region is kept under backyard, free ranging conditions, allowing for exposure to migratory birds, with the potential of HPAI transmission.

Migratory routes from Central and Northern Asia, where HPAI in wild birds has been diagnosed, increases the chances that birds overwintering in Northern and Eastern Africa's wetlands, rivers, and shorelines may transmit the disease to local wild birds, and from there to domestic poultry. This transmission pattern has been identified in other regions.

Although the human and poultry populations in the Region are relatively low, the Region is crossed by several important flyways crossing from Central and Western Europe into Africa. A significant proportion of birds are raised under free ranging conditions, allowing for potential contact with migratory birds. Informal domestic poultry trade within and among countries in the region may also contribute to the dispersal or spread of HPAI and needs to be assessed and monitored.

Countries in the North and Eastern Africa regions, close to or in the way of migratory bird flyways or harboring wetlands, streams or shorelines, are at risk. Also countries in Western and Central Africa may be at risk. Some migratory flyways also stretch from currently infected areas to Western and Central Africa.

With regard to Central and West Africa, the immediate risk of contamination during the 2005-2006 wintering season is considered to be low but not totally absent. The problem is that if HPAI enters East Africa, the virus could infect wild birds coming from West and North Europe. It could therefore spread to these regions where migratory birds will be in contact with birds coming from Central and West Africa making further spread possible during the next 2006-2007 wintering season.

3.3.3.5 Western Europe

The member states of the EU have a well developed veterinary structure and up to date contingency plans. Also routinely surveillance programs have been set up for domestic poultry as well as wild birds. In case of recurring outbreaks of HPAI the EU countries will be well equipped to eradicate the disease quickly.

4. OPPORTUNITIES FOR CONTROLLING HPAI

4.1 Methodologies and technologies for the control of HPAI are available and accessible

4.1.1 Diagnostic tools for the identification of HPAI infection are well developed. Active, targeted surveillance following the diagnosis of HPAI infection, followed by at-source culling of infected birds and strict biosecurity measures, have been the mainstay for the control and eradication of the disease (Appendix 2). Diagnostic tests for the characterization of AI viruses are sensitive, and well defined in the *OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (the Terrestrial Manual)*.

4.1.2 Disease investigation facilities capable of carrying out an array of diagnostic tests are present in the Region. Adequate diagnostic facilities exist in many countries in Asia, Africa, the Middle East and Eastern/Central/Southern Europe, most of which can provide regional support to countries with fewer facilities. In addition, selected facilities in each region have substantial diagnostic capacity, such as, for example, the new HPAI Virus Reference Laboratory in Hanoi, and regional veterinary laboratories in Budapest, Islamabad, Nairobi, Bangkok, Dakar, Tehran and Alma Ata. North America, West Europe, Mexico and the major countries

in South America are well equipped to carry out diagnostic HPAI technologies, and can provide technical backstopping to other countries in their region.

4.1.3 Vaccines that are highly efficacious, safe and affordable are commercially available. Strategic use of vaccination, as part of the overall integrated strategy to control the disease, and with a clearly defined exit strategy using DIVA approach, has been successful in many instances to control the disease. More details on HPAI vaccines and vaccination can be found in relevant *OIE Terrestrial Manual* (see Appendix 4) and in the FAO Position Paper produced in collaboration with OIE *Recommendations on the prevention, control and eradication of Highly Pathogenic Avian Influenza (HPAI) in Asia, September 2004*, (<http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/27septrecomm.pdf>) and in the Section on Considerations for National Strategies. Ensuring vaccine quality control is a significant issue in many countries, and should form part of the national intervention strategies of countries at risk or infected.

4.2 Control and eradication is feasible – learning from the success stories

The tools, methodologies and approaches outlined above have been successfully used by many countries to control and eradicate HPAI infections in Europe (Italy and the Netherlands) and North America (Mexico, USA and Canada).

To date, HPAI H5N1 outbreaks have been stamped out in Hong Kong SAR, Japan, Republic of Korea, DPR Korea and Malaysia. Thailand, after 14 difficult months, has made tremendous progress in controlling the disease through enhanced surveillance, strict biosecurity measures and culling of infected poultry. The disease has now been almost eradicated in the commercial poultry sector (sectors 1, 2 and 3, see Table 3) and probably pushed back into village poultry and free-ranging domestic ducks in the Central Plain. Most of these countries have the resources to deploy the necessary control measures and provide improved veterinary services and surveillance to support HPAI control. While these success stories provide encouragement that concerted efforts do in fact pay off in the control of avian influenza, they also clearly point to the high level of investment required to support HPAI control, not always available to countries less endowed with the necessary human or physical resources.

4.3 National and regional commitment to control HPAI is strong

Without the necessary political and financial commitment by affected countries and regional organizations, HPAI will be very difficult to overcome. It has been highly encouraging to witness that affected and at-risk Asian countries have prioritized HPAI as the most important TAD that is currently threatening their livestock sectors. During the Ho Chi Minh City Regional Meeting, all affected and at risk countries made strong commitments to support long-term efforts to control the disease. The regional organizations such as ASEAN and SAARC have prioritized HPAI as a transboundary zoonotic disease of the highest significance. Recently ASEAN HPAI Task Force was endorsed at the ministerial level to start plans for the long-term control of HPAI. SAARC, with FAO/OIE collaboration, is currently considering a regional programme for the control of TADs.

4.4 International commitment to control HPAI is strong

A joint FAO/OIE agreement (May 2004) to control transboundary animal diseases globally (GF-TADs) has been signed by both organisations and endorsed by all OIE Member Countries (Appendix 1). It has also been agreed that the HPAI crisis should be addressed under this initiative. Following the HPAI outbreaks, FAO and OIE have responded very rapidly in mobilizing financial resources and technical support to control the disease (see Appendix 5). In the

15 months since the first outbreaks, country-specific support has been provided to all the infected countries and sub-regional networks. Centres have been established in the three sub-regions (EA, SEA and SA) and an Emergency Centre for the Control of Transboundary Animal Diseases (ECTAD) has been created in the Animal Health Service of FAO headquarters in Rome. FAO has a strong animal health capacity in its Regional Office in Bangkok (FAORAP), supporting ongoing regional and national TCP funded projects. FAO has been able to generate significant donor interest to support HPAI control. FAO, OIE and WHO have also organised joint regional meetings and international consultations to develop recommendations and guidelines for HPAI control.

The OIE/FAO Collaborating Centres and the World Reference Laboratories for avian influenza have actively supported efforts to control the ongoing crisis, and recently OIE and FAO have created the OIE-FAO Network of Expertise on avian influenza (OFFLU). Industrialized countries in Western Europe and North America as well as countries in Asia such as Japan, Korea, Australia and New Zealand have invested heavily in imposing strict measures to control transboundary animal diseases, but are also increasingly recognizing the fact that the source of many of these infections is in developing countries. In these countries, governments and the livestock farming communities have limited resources to control animal diseases. This recognition is leading the 'disease-free' countries to focus on controlling HPAI at source rather than building disease-free corridors.

4.5 Greater awareness of policy issues for HPAI control

Many affected or at risk countries now recognise the need for strengthening their regulatory policy frameworks to enforce animal disease control measures and support formal intra-regional and global trade, and are realigning their veterinary regulations and policies to meet WTO/OIE standards. These mechanisms include quality and evaluation of Veterinary Services, animal quarantine, institutional reforms, introduction of OIE standards, guidelines and recommendations for trade in livestock and livestock products, certification for exports and designation of disease free zones and compartments. Where needed, longer-term national or regional HPAI control or prevention interventions should support strengthening such frameworks to create the necessary enabling environments. In addition, these countries support major poverty reduction goals and recognise that control of HPAI and other TADs will have a significant positive impact on increased livestock production, greater access to regional and world markets, and improved livelihoods for the rural poor in their countries.

5. CONSTRAINTS AND CHALLENGES TO HPAI CONTROL

There are many constraints to controlling HPAI, and these vary tremendously, and mainly depend on the particular country and its farming system. Key constraints are elaborated below.

5.1 Inadequate veterinary services - a major weakness

The veterinary services in several affected countries in Asia were inadequately equipped to deal with the scope, severity and rapid spread of the HPAI epidemics. Control measures and approaches vary significantly in confined commercial (Levels 1 and 2) and semi-confined or free-housed rural (Levels 3 and 4) poultry production systems. As a result the disease has become endemic, especially in the smallholder poultry sector. This situation further complicates disease control programme in some countries as the well established methods of culling, bio-security and movement control on their own may not be sufficient to control the disease.

The veterinary services of also vary greatly in capability and resources. Many countries will require substantial financial resources to upgrade their capacity and train personnel to more

effectively support their national programmes and participate actively in regional efforts to control HPAI. In several countries, the necessary policies to establish common ground between public and private health service providers are unavailable to effectively support economically viable disease control for both smallholder farmers and small-scale processors and traders. Common constraints to effective disease recognition and control in countries with weak veterinary infrastructure include:

- Poultry farming in the region is predominantly a rural, or backyard enterprise
- Animal disease information is generally lacking
- Wild birds and domesticated ducks are believed to be major H5N1 reservoirs
- Levels of consumer and farmer awareness are low
- Little emergency preparedness exists
- Human resource capacities for human and animal health are limited
- Intersectoral and interagency coordination is limited

5.2 Stamping out and biosecurity measures are difficult to implement

One of the most important aspects of HPAI control and prevention is the application of stamping out combined with biosecurity measures. The concept, preventing the spread of virus from infected premises (bio-containment), and measures requiring the exclusion of infectious agents from uninfected premises (bio-exclusion), has been very difficult to practice in several countries in affected regions. Particularly, wherever the disease has become endemic and widely spread in the smallholder poultry sector and domestic ducks, standard biosecurity measures are less effective. The lack of capacity, or regulatory enforcement power to stamp out or practice even basic biosecurity measures is one of the most important reasons of persistence of the disease and its spread in the region.

5.3 More epidemiological expertise is needed

It is vital that countries and regions are able to incorporate epidemiological studies linked to disease control programmes to generate quantitative and geo-referenced data on infection and transmission dynamics. Such information can provide a sound basis for the control and prevention of HPAI. However, in a number of countries in the region, epidemiological expertise remains weak, because modern epidemiological methodologies and tools such as GIS, database management and analysis are not available.

5.4 Inadequate disease information systems

The importance of a harmonised disease information system linked to disease surveillance and epidemiology programmes in countries and regions is clearly recognised. The OIE animal disease information system requirements, the application of which is mandatory for OIE member countries, are now closely followed. FAO's national TCPs have also supported disease reporting systems in Asia and beyond. However, this effort needs to be further strengthened and made sustainable to support long-term disease control programmes. There is also additional need to form a sub-regional network for the sharing and analysis of disease information coordinated through a sub-regionally based epidemiology support unit. Such infrastructure will be an important element in the control of HPAI.

5.5 Domestic ducks are an important H5N1 reservoir

Over the last 15 months, several studies, including a retroactive analysis of the HPAI virus evolution and field evaluation of its spread in PR China, Viet Nam and Thailand have shown that domestic ducks have become an important reservoir host of the H5N1 virus. The nature of farming systems in some countries, where domestic ducks are moved in flocks over long

distances from province to province to feed on harvested rice fields, plays a major role in the transmission and maintenance of the HPAI virus, and in compromising the traditional control measures of active surveillance, culling of infected flocks and imposition of biosecurity. This finding is of critical importance. Significant correlations were found between the presence of free-grazing ducks and HPAI outbreaks in domestic poultry in Thailand. Twenty percent of clinically normal ducks in the Mekong Delta of Viet Nam were found harboring the HPAI virus. Preventing the intermingling of ducks and domestic poultry would serve to significantly reduce HPAI transmission. Alternatively, targeted control and eradication of HPAI infection in domestic ducks, either by culling of infected animals and by introducing disease-free domestic ducks, or by strategic vaccination of domestic ducks, may reduce or eliminate that source of infection. These measures, combined with culling, biosecurity and vaccination of domestic poultry, where appropriate, may provide an important window of opportunity to control the disease in some countries and eventually progressively eradicate the virus from a variety of poultry production systems. In countries with substantial duck populations, stamping out and control will be more difficult to achieve. Reverseely, countries with low-density poultry populations will have a geographic and structural advantage in controlling the infection.

5.6 Disease has become endemic in several countries

Implementing control measures in countries with a predominantly (free ranging) smallholder poultry sector, in which the disease has dispersed widely, is a major challenge in the face of limited veterinary infrastructure. One of the continuing dangers of resurging HPAI outbreaks lies in the smallholder farming systems where the disease is most difficult to control. Smallholder animal producers have limited access to preventive treatment, information and advice, or access to training. It is now generally accepted that HPAI has become endemic in many parts of Indonesia, Viet Nam, Cambodia, Lao PDR, and Thailand. There are also concerns that some genotypes of H5N1 strains might have adapted to backyard indigenous terrestrial poultry in the same way as observed in domestic ducks. Similar situation may also exist in Pakistan with the H7 and H9 strains. Such a situation will increase the complexity of controlling the disease particularly in the large section of backyard population of poultry in the affected countries. Preventing the recurrence of HPAI in endemic areas is very important. Some regions in South Asia and Central Asia contain highly concentrated, predominately smallholder poultry sector, including a significant populations of ducks.

5.7 Wildlife reservoirs are a source of HPAI infection

Epidemiological observations suggest that wild birds very likely played a role in the transmission of H5N1 viruses to domestic poultry. The capacity of wild birds to carry HPAI H5N1 viruses presents a major difficulty in applying biosecurity measure aiming at the avoidance of contacts between domestic poultry and wild birds. Eradication of the virus to prevent HPAI infection may not be completely achievable in certain farming systems. There is increasing evidence that the introduction of H5N1 from Southeast and East Asia to other regions may have been due to migratory wild birds from which H5N1 was isolated, and could have died from the disease along their migratory routes. However, some findings also suggest that H5N1 viruses could have been transmitted between migratory birds. The introduction of HPAI to other parts of Asia may indicate that some migratory bird species act as carriers, and can transport HPAI over longer distances. Short-distance transmission between farms, villages or contaminated local water bodies is likewise a distinct possibility.

5.8 Failure to base disease control planning on socio-economic impact assessment

Sound economic impact assessments of HPAI control are essential to determine national economic and social intervention priorities, as well as the cost-benefit of implementing control programmes. Such assessments should take into consideration trade issues, poverty reduction targets, veterinary and livestock development programmes, socio-economic impact and economic policies, and should have a pro-poor orientation. Such analysis is presently lacking, and therefore the targeting of disease control programmes through well developed policy frameworks remains largely empirical.

5.9 Weak linkages with public sector

Weak linkages between technical and planning departments, between ministries of agriculture, human health and finance, hamper long term planning for infectious disease control. Given the zoonotic and transboundary nature of the disease, appropriate linkages and policies need to be in place among a number of ministries, and groups at the national (e.g. provincial, district, community and farmer levels), regional and international levels to enhance coordination of HPAI control.

5.10 Sustainable long- term regional coordination is badly needed

Through FAO support and under the GF-TADs framework, sub-regional networks on diagnosis, surveillance, policy and economics have been established as the first regional coordination mechanism in the control of HPAI. Eventually, regional organizations such as ASEAN and ASEAN+3 (including PR China, Japan and Republic of Korea), SAARC, and ECO, AMU, AU-IBAR and SADC in Africa, should take the lead when feasible or contribute to manage such networks for long-term sustainability. Sufficient funding is essential for the long term sustainability of these coordinating efforts.

5.11 Financial resources remain inadequate

Over \$18 million in donor funding, and significantly higher amounts from various governments of the affected countries, have been spent to mitigate the ongoing HPAI crisis. These financial resources have primarily focused on providing critically needed supplies, equipment, reagents and technical support. However, the ongoing crisis, the increasing spread of the disease and the increasing number of human cases, combined with evidence that the disease has now become endemic in some Asian countries, necessitates a long-term commitment of significantly higher levels of financial support if HPAI is to be controlled world wide.

6. IMPLEMENTATION OF THE STRATEGY

The strategy will be implemented at three levels: national, regional and international. The main components for each of these levels, together with their associated activities, are presented in Appendix 7. Summaries of issues at each level of implementation are given below.

6.1 National level: Development of national HPAI control strategies and programmes

The cornerstone of the national strategies in the Southeast Asian region will be the development of country specific disease control plans that are consistent with the global strategy. To this end, FAO is currently assisting several countries to develop their own country specific disease control plans. A typical country specific project will adopt a task-force approach, guided by a national steering committee to support a comprehensive HPAI control programme. The function of the task force will be to coordinate and monitor disease control programme. The task force is expected to be lead by the department of veterinary services with strong linkages with ministries of health, planning and finance, extension services, community workers and NGOs. The national steering committee will comprise key decision makers

and stakeholders and may include national experts, research institutes, NGOs and the private sector. Some of the specific issues for each of the target countries are outlined in Appendix 6. The strategy recognizes that the complete eradication of HPAI virus in Asia may not be possible because of its presence in the wild bird population. Important areas of focus at national level are outlined below:

- Strengthen legal and institutional frameworks to create an enabling environment for supporting control of HPAI.
- Strengthen national veterinary services.
- Develop and implement effective HPAI control programmes.
- Prevent the introduction of HPAI in countries currently free from the disease.
- Provide socio-economic impact assessments on disease control strategies and, where necessary, provide an objective assessment of the impacts on different stakeholders.
- Prepare contingency and emergency preparedness plans for each country.
- Improve capacity at the national level in diagnosis, epidemiology, disease surveillance, and early detection and reporting and disease information systems.
- Strengthen links between technical and planning departments and between ministries of agriculture, human health and finance, to improve capacity for long-term strategic planning and response to emergency situations.

Further details on indicative activities are presented in Appendix 7.

Key issues common to all the countries that will be addressed in developing national control programmes are further discussed in the Section entitled ‘Technical and Policy Considerations for national strategies’.

6.2 Regional level: Sub-regional Cooperation and Collaboration

The cornerstone of the regional strategy will be the establishment of strong and efficient regional coordination units constituted to ensure that the disease control plans are implemented in a systematic, coordinated and phased manner. These regional coordination units will support country-specific efforts to control HPAI. Three sub-regional HPAI support units are currently in operation in each of the three sub-regions of Southeast Asia, East Asia and South Asia. The focal points for these units are expected to be regional organizations such as ASEAN and SAARC. Through these units, sub-regional networks for disease surveillance, diagnosis and information and for policy development and economic impact assessment will be further strengthened and followed up by either FAO/TCPs or donor support. FAO in close collaboration with OIE will promote and encourage participation of regional and subregional organization (amongst others AU-IBAR, SADC, AMU, AOAD, GCC, ECO and EU). These networks will be coordinated, with technical backstopping from FAO (FAO AGAH and FAORAP), OIE and OFFLU, and are expected to serve the sub-regions by promoting open and transparent dialogues on improved disease information sharing, standardization and regulatory frameworks for the management of animal movement and the control of TADs, and adherence to OIE guidelines to facilitate regional trade. Such collaboration will also develop standardization and harmonization of HPAI diagnosis, surveillance and monitoring protocols and disease reporting, regional trade in livestock and livestock products, and HPAI emergency preparedness planning. Sub-regional collaboration will also address policy and regulatory issues related to the safe poultry production and trade. Other important issues that the regional networks will address will include:

- Institutionalized and inter-sectoral coordination
- Programme management
- Capacity in diagnosis, surveillance and epidemiology

- Capacity in policy and socio-economic impact assessment
- Public awareness
- Research and development

Indicative activities considered by the sub-regional support units are shown in Appendix 7.

6.3 International level: global coordination

The global nature of HPAI necessitates countries to engage in internationally agreed plans for the control of transboundary diseases. An international support facility to coordinate the implementation of the strategy is a prerequisite. It is proposed that such a facility will be based at the FAO headquarters, within the Animal Health Service (AGAH), and will operate under the GF-TADs mechanism, and the FAO/OIE agreed global initiative to control TADs. The main responsibility of such a facility will be to:

- forge partnerships among the three international organizations, FAO, OIE and WHO
- coordinate the subregional networks
- develop the Global Early Warning System (GLEWS) to enable better analysis of the emergence of new infectious diseases
- backstopping subregional networks through the OIE/FAO epidemiology collaborating centres, World Reference Laboratories, including OFFLU.
- play a strategic role in coordinating research in improved tools for HPAI control
- provide a global vision for HPAI control strategy, along the lines of the Global Rinderpest Eradication Programme (GREP), a successful global animal disease eradication programme.
- mobilize and allocate resources for HPAI control and prevention through active donor liaison

Given the interface between animal and human disease, and the dimension of food safety, strengthening the partnership between FAO and WHO will be important. A number of common activities, such as disease information sharing, joint field investigations, epidemiological studies, sharing of virus strains, contingency planning and public awareness will be important. Such a partnership will also organise and conduct joint regional and international workshops and meetings, develop harmonized HPAI control strategies for poultry and humans and enhance cooperation among the various OIE/FAO and WHO collaborating centres and reference laboratories.

Indicative activities of the global coordination are shown in Appendix 7.

6.4 Development of regional projects in new regions at immediate risk

The strategy outlines the prevention HPAI introduction into new countries at risk. In case the disease is newly introduced, an adequate and rapid response is necessary in preventing the creation of endemic areas, thereby preventing risk to human health.

The strategy includes a regional approach for six regions: Central Asia, West Africa, Eastern Africa, North Africa, Eastern Europe/Caucasus region and Middle East. All the 6 approaches include immediate response at national level, regional and international coordination.

The immediate response at national level focuses on:

- Emergency preparedness and Surveillance, including
 - 1 public awareness and communication strategy

- 2 grassroots early warning networks
 - 3 field surveillance
 - 4 bottom-up information feedback
 - 5 contingency planning
- Strengthening of diagnostic capacity and laboratory support, including
 - 1 risk assessment of national diagnostic capabilities and needs assessment of human and physical resources
 - 2 laboratory upgrading through training and provision of laboratory consumables for serological and virus detection of HPAI
 - 3 liaison with international reference laboratories for H5 subtyping, research institutes and agencies (WHO, OIE, others)
 - Emergency response, including
 - 1 preparation for stamping out and biosecurity
 - 2 possible vaccination plans
 - 3 compensation policy and strategy

Coordination units will, in order of priority, be established in Central Asia, Near East, Southern Europe, and North, West and Eastern Africa, as a part of six regional approaches for the new countries at risk. Through these Units, sub-regional networks for disease surveillance, diagnosis and information and for policy development and economic impact assessment will be strengthened and followed up by either FAO/TCPs or by donor support. FAO in close collaboration with OIE, will promote and encourage participation of regional and subregional organization (amongst others: AU-IBAR, SADC, AMU, AOAD, GCC, ECO and EU).

The global nature of HPAI necessitates countries to engage in internationally agreed plans for the control of transboundary diseases. An international support facility to coordinate the implementation of the strategy is also prerequisite for the projects in the new regions at risk.

7. TECHNICAL AND POLICY CONSIDERATIONS FOR NATIONAL STRATEGIES

A number of technical and policy issues related to the development of national strategies are of importance, and should be prepared, and agreed to, well before the eventuality of an outbreak. Several of these have been covered, but are worthy of attention in developing national strategies. These are elaborated below.

7.1 Disease control options and strategies

Country-based disease control strategies will be broadly based on the following options:

- Effective risk-based disease surveillance for early detection, diagnosis and reporting.
- Immediate stamping out new outbreaks when and where human life is at risk.
- Enhanced biosecurity of poultry farms.
- Control of movement of poultry and poultry products that may harbor virus, including controls at the interface of infected and uninfected areas.
- Rapid, humane culling of infected and ‘at high risk’ poultry and safe disposal of carcasses.
- Strategic vaccination.
- All of the above underpinned by appropriate financial supporting mechanisms including public and private sources.
- Changes to industry practices such as control of live bird markets and farm hygiene, to reduce risk
- Separation of poultry species into compartments.

In designing country-specific control measures, an approach using a combination of the above-listed measures will be deployed, depending on the situation of each country. The details of the above noted measures are set forth in the FAO's *Recommendations for the Control of HPAI*.

7.2 Epidemiology-based control measures

The lack of reliable epidemiological information, and the sound analysis thereof, has hampered the development of rational, targeted disease control measures in many countries. Thus well-structured epidemiological studies and surveillance programmes will be integrated with the disease control measures, which will be then adjusted and improved as new information becomes available.

The following country-specific risk-based surveillance strategies will be used:

- Identification of factors governing infection dynamics should complement simple case finding.
- Determination of disease transmission pathways along the production and market chains.
- Molecular characterization of HPAI virus strains from birds and animals to determine geographical locations and genetic changes.
- Evaluation of the level of human exposure in different circumstances to determine risks of human-to-human transmission.

Participatory methodologies involving farmers, paraveterinarians and community workers, will be used extensively, given the fact the major control targets are the small-scale and semi-commercial poultry production systems 3 and 4 and 5 (Table 3). Surveillance programmes will be planned and implemented jointly with the public health personnel.

7.3 Disease information systems

A uniform disease information system will be introduced to member countries as part of their control programmes to provide better analytical capacity. This will enable countries to participate in disease information sharing within their region, thereby contributing towards progressive regional control and eradication. The system will be linked with rapid and standardized methods of routine analysis of surveillance data, which will demonstrate important changes in the H5N1 situation, and promptly supply this information to field personnel. The activation of such systems should go hand in hand with training in epidemiological principles so that sound data analysis becomes possible.

7.4 Targeting the source

In developing country-specific HPAI control strategies and programmes, the broad principle of targeting the disease at source of infection will be applied. This refers predominantly to the smallholder poultry sector and the domestic duck population, a major carrier host reservoir. Wild-birds are also implicated as reservoirs of disease, but the strategy does not address the eradication of avian influenza viruses in avian wildlife, a concern that, given increasing reports of the role of wild birds in contributing to the spread of HPAI, is receiving increasing priority.

Eradication of the virus source from backyard poultry will be a difficult and long-term task, especially in poor countries with limited resources. With growing evidence that the survival of the virus in smallholder and backyard poultry is dependent on replenishment by carrier

domestic ducks and potential contact with wild carrier birds, strategically targeting virus eradication in domestic ducks and wild birds may well be the best option for cutting off this source of infection. The strategy will therefore explore disease control options for domestic ducks and wild birds, including restructuring of domestic duck farming systems to separate domestic ducks from terrestrial poultry and wild birds, strategic culling of domestic ducks, and progressively enhancing flock immunity through vaccination to reduce virus shedding.

The short- to medium-term task of controlling the disease by reducing virus circulation in the industrial poultry production sector, large-scale breeder units, and medium to small-sized commercial units is far more feasible. Reducing virus loads in the smallholder commercial poultry sector significantly reduces the risk posed to humans, as available evidence suggests that humans become more frequently infected when and where the incidence of HPAI outbreaks in poultry remain high.

7.5 Use of avian influenza vaccines

FAO and OIE have made recommendations for the use of OIE-approved HPAI vaccines, and several such vaccines are commercially available. If used in accordance with FAO/OIE recommendations (*FAO Position Paper, September 2004*) and OIE Manual (see Appendix 4), these vaccines provide excellent protection against clinical disease in chickens by reducing mortality and production losses. Vaccination of poultry also reduces the virus pool contaminating the environment and thereby the risk of infection to poultry and humans. According to current OIE recommendations, HPAI-vaccinated poultry is not excluded from the export trade, although specific technical guidelines must be followed to ensure that the vaccine is being applied properly and monitored effectively.

The use of vaccination to control HPAI must go in tandem with strategic field surveillance and epidemiological studies to identify virus sources, selection of priority hot spots, imposition of transport bans, and post-vaccination monitoring. Zoning and ring vaccination are important tools, depending on the incidence of virus survival in carrier domestic duck populations. Whereas vaccination of commercial poultry farms can be carried out easily, vaccination of backyard, non-confined poultry poses significant logistical and technical problems. Domestic ducks probably react differently from terrestrial poultry to HPAI vaccination compared with poultry in that they might continue shed virus on challenge, and therefore remain potentially infective. Serological monitoring using DIVA principle, and the use of sentinel domestic ducks and chickens are essential measures to monitor vaccinated domestic duck flocks.

Currently, PR China, Viet Nam, Indonesia and Pakistan are the only countries using vaccination as part of their HPAI control strategy. Viet Nam has recently included vaccination as a containment tool, and other countries may follow. In countries practising vaccination, the vaccination strategy was adopted mainly because the disease had spread widely throughout the smallholder poultry sector, particularly in production systems 2, 3 and 4 (medium to low level of biosecurity) (Table 3), accompanied by very high animal mortality. Given the large scale of the infection and the limited capacity to mount large-scale surveillance, stamping out and biosecurity measures, vaccination was adopted as an important part of the control strategies in Indonesia, PR China and Viet Nam. There is good evidence to show that this approach has served to significantly reduce losses due to HPAI.

The global strategy will support the use of good quality HPAI vaccines produced according to OIE standards and implemented according to FAO/OIE guidelines. The strategy will also promote building capacity in vaccine quality control at the national level. The strategy will

ensure that vaccines are used with a clearly defined objective and time-phased exit strategy, linked to strict post-vaccination surveillance and monitoring. The strategy will also work with the private sector to ensure that sufficient stocks of vaccines are available prior to launching the vaccination programme.

7.5.1 Vaccinating ducks – useful or questionable?

The successful use of HPAI vaccination in domestic duck populations would be a major step forward in controlling domestic duck-borne HPAI infective reservoirs; the suspected principal source of re-infection of terrestrial poultry. However, the HPAI disease syndrome takes a different course in domestic ducks from other poultry. Affected domestic ducks show lower morbidity and mortality than chickens but become virus shedders. Recent studies in Viet Nam indicate that close to 20% of asymptomatic domestic ducks in the Mekong Delta shed significant quantities of HPAI virus. The efficacy of currently available OIE approved vaccines in domestic ducks has not been clearly established and requires further epidemiological study and field trials. While preliminary studies in PR China suggest that some vaccines may be effective in domestic ducks, this claim urgently needs further evaluation. FAO, OIE and their partners will play an important role in coordinating the evaluation of the efficacy of the currently available H5 based poultry vaccines in domestic ducks. The outcome of the vaccine evaluation in domestic ducks will be of great importance, and would determine the future strategies for controlling virus shedding in reservoir hosts.

7.6 Personal safety issues

Due to the highly infectious nature of the HPAI virus to humans, particularly H5N1, biosecurity training of people in potential contact with live virus will be conducted. This will include field workers involved in identification of the disease, farm workers involved in culling, and laboratory workers involved in virus isolation and diagnosis. Adequate resources will be allocated for biosafety hoods and appropriate personal protective clothing.

7.7 Policy development provides the enabling environment

In order to ensure that recommended disease control, prevention and eradication measures are implemented in a uniform manner, the regulatory framework and a number of policy issues will be addressed. These are related to stamping out, biosecurity, vaccination, emergency preparedness, control of animal movement, border control, culling and disposal of carcasses, compensation, restructuring of poultry industry, compartmentalization and zoning, and regulations related to recreational activities related to poultry.

7.8 Pro-poor disease control programmes

Many of the world's poor rely on small-scale or backyard poultry raising for their livelihood. This group has little or no access to veterinary services. The strategy will particularly support these low-income groups by:

- Improving animal health services at village level by means of organising community based early warning networks, utilising the existing pool of paraveterinary village workers.
- Increasing farmers' general awareness through simple biosecurity guidelines on avian influenza control using publications in local language.
- Providing access to credit or microfinance as a tool for rehabilitation as an alternative to direct compensation, which some countries may not be able to afford.
- Developing farmers' groups and/or associations to help improve awareness and dissemination of information.

7.9 Restructuring of the poultry sector

Restructuring the poultry sector may be an important strategy to guard against the damaging effects of HPAI, but is also one of the most complicated interventions to be undertaken requiring understanding of the whole socio-economic system. Restructuring requires different approaches at different poultry sector levels in different countries, by virtue of the differences in their poultry sector infrastructures, marketing characteristics, backyard versus commercial poultry production, and socio-economic impact. Restructuring should be seen as a gradual process, affecting the various segments of the sector in different ways and at different rates. Because of these variations, only the general principles that may be undertaken are outlined below:

- **Rationale** for restructuring should always be based on a well-defined socio-economic impact analysis, taking into account the interests of all stakeholders.
- **Government commitment** with full support from stakeholders is necessary and must follow a long-term strategy.
- **Livelihoods of smallholder poultry farmers**, who represent the majority of poultry in many HPAI-affected countries, should be taken into account.
- **Market forces** should drive the restructuring strategy taking into account commercial and smallholder poultry producers.
- **Public and private sectors should collaborate and be transparent** in the implementation of restructuring strategies.
- **Restructuring should be an integral part of an overall disease control strategy**, that includes biosecurity, vaccination, zoning and/or compartmentalization, should follow OIE and FAO guidelines, and take into account issues of human and food safety.
- **Public awareness** should be promoted to gain support from producers, consumers, government agencies, private sector institutions and other stakeholders.

7.10 Compartmentalization and zoning

Given the current epidemiological situation of HPAI in various affected countries, complete eradication may not be achieved in the next 5-10 years. Therefore, compartmentalization and zoning concepts, as described in the OIE guidelines, will be an important tool in assisting the recovery of marketing opportunities for many affected countries, especially those with significant poultry export industries. Thus, in considering disease control strategies, progressive control will focus on developing disease-free compartments and zones, made safe from re-infection.

7.11 Collaboration with stakeholders

The multi-dimensional problems associated with HPAI infection necessitate collaboration from a wide range of stakeholders within each country. These include:

- Various ministries such as planning, finance, agriculture, health, road and transport, livestock departments, veterinary departments, national research institutions and diagnostic laboratories.
- NGOs, private sector (e.g. large poultry production companies, farmers' associations, veterinarians) and farmer involvement at the grass roots level.
- One of the most important linkages will be with the public health sector given the zoonotic nature of the disease. Disease control plans, surveillance programmes, and post-vaccination monitoring will be conducted jointly with the personnel from the departments of health, and the disease information and biological material will be shared.

- Private sector stakeholders (feed mills, drug and vaccine companies, breeder farms, others) have a role in providing timely and accurate disease information to their clients, and can do so by including informative messages on their products, and by direct contact through sales representatives and technical staff.

7.12 Capacity building

The development of a strong, sustainable human resource base is one of the most important objectives of country-specific disease control strategies. There is a great variation in capacity to deal with serious outbreaks of infectious disease across the world, and the capacity building needs to be tailored to specific circumstances prevailing in each country. Capacity will involve institutional strengthening and human and physical resource development. On the institutional side, training will be provided in various aspects of policy development and economic impact assessment to include poultry sector restructuring, compartmentalization and zoning, compensations and emergency preparedness planning. On the human resource side, training will be provided in all aspects of disease control from the national to the grassroots level. In the regard, training of paraveterinarians and other lay workers will be an important aspect to develop grass-roots level early disease detection network. At the technical level this will include disease detection, laboratory diagnosis, risk-based surveillance, risk analysis, vaccine quality control, vaccination delivery and monitoring, and biosecurity. On the physical resource side, laboratory diagnostic and surveillance capacity will be strengthened by upgrading equipment and disease information systems.

7.13 Applied research

While a range of methodologies and tools are available to control HPAI, a number of aspects of the disease are not clearly understood. A set of recommendations for research was recently made by the participants of the OIE/FAO International Scientific Conference on Avian Influenza, OIE Paris, France, 7–8 April 2005 (see Appendix 8). While many of these research issues are beyond the scope of this strategy, it is proposed some of these issues can be studied immediately and be linked with the national disease control plans. The key among these issues are:

- To elucidate the role of ducks and backyard indigenous poultry in maintenance and transmission of H5N1 to terrestrial domestic poultry.
- To determine the efficacy of HPAI vaccines in ducks, quails and indigenous backyard poultry.
- Assess the role of vaccination in reducing virus shedding in carrier birds.
- To determine the appropriate strains to be used in each country.
- To determine the role of pigs and other wild birds in transmission of H5N1 to domestic poultry.
- Identify major risk factors for transmission of HPAI to humans and domestic poultry.

A newly emerging research topic is the role of migratory wild birds in contributing to the spread of HPAI. Monitoring, sampling and analysis of the viral subtypes of avian influenza found in wild birds need to be done in order to fully understand their role in the propagation and spread of highly pathogenic avian influenza viruses. A multidisciplinary approach is required that brings together the competencies of veterinarians, wildlife specialists, ornithologists, virologists, molecular biologists and other resource avenues.

It is expected that many of these studies can be included in the national disease control plans and the disease control strategies revised and improved in light of new findings. China has

had significant experience in the use of HPAI vaccines in ducks and domestic terrestrial poultry. This experience will be of great help in designing disease control strategies for other countries in the region.

8. OUTPUTS

Successful implementation of the strategy will result in the following major outputs:

- HPAI spread in humans and poultry will be contained.
- HPAI incidence in poultry will be progressively reduced.
- Progressive HPAI eradication in all commercial farming systems and zones will be achieved.
- Introduction or establishment of HPAI will be prevented in non-infected at risk countries.
- Emergency preparedness plans will be available in all countries at risk.
- National, subregional policies on HPAI control will be available and implemented.
- Enhanced HPAI control capacity will be developed.
- Improved understanding of virus epidemiology will be available.
- The appearance of new endemic reservoirs of domestic poultry will be minimized.
- Risk of human pandemic will be progressively minimized, and safe trade in poultry re-established.

9. IMPACTS

A successfully implemented strategy will directly impact the livelihoods of millions of commercial, smallholder and backyard poultry farmers and their stakeholders, and contribute significantly to the achievement of the Millennium Development goals. It is expected that these outcomes will also impact positively in the reducing poverty of resource-poor smallholder farmers, in improved food safety and decreased health hazards for consumers, and in better market opportunities for poultry producers at all economic levels.

10. IMPLEMENTATION

Country specific activities will be technically supported and coordinated by regional organizations across the world, as has taken place in Southeast and East Asia. The diagnostic and surveillance and policy and impact assessment networks for each of the sub-regions will be operated by the respective regional organisations. International HPAI support will be provided from FAO Headquarters in Rome, within the Animal Health Service (AGAH) in collaboration with OIE Headquarters in Paris. The main responsibility of the international support will be to deploy the obvious synergies between the three international organizations, FAO, OIE and WHO (see below) and regional organisations.

11. MAJOR PARTNERS

A list of major partners is shown in Appendix 9.

11.1 Participating countries

The control of HPAI is a multidisciplinary exercise, addressing the complex interactions between technical, institutional, policy, political and socio-economic issues, all of which necessitate engagement of a large number of partners. The key players in the originally HPAI-infected countries of South East Asia are Cambodia, Lao PDR, Indonesia, Thailand and Viet Nam), East Asia (PR China), and South Asia (Pakistan), and newly infected countries in East Asia (Mongolia). Non-infected, 'at risk' countries include in East Asia DPR Korea, Japan, Republic of Korea, in Southeast Asia Brunei, Malaysia, Myanmar, Papua New Guinea, Phil-

ippines, Singapore and Timor Leste, and in South Asia Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka. These countries, as part of their respective sub-regional organizational networks, will form the core alliance to control HPAI in Asia. Each partner country has unique strengths and skills that will contribute in a complementary and synergistic manner to achieve the objectives of the programme.

New regions at risk following the spread of HPAI from Southeast Asia include in order of priority:

- Central Asia
- Eastern Europe and Caucasus
- Middle East
- North Africa
- Eastern Africa
- West Africa

Regional organizations in these new areas of risk will be engaged to coordinate intervention activities, together with the sub-regional, regional and international coordination and backstopping provided by FAO and OIE.

11.2 Regional Organizations

Many of the participating countries are members of the two major inter-governmental organizations (ASEAN and SAARC) in Asia. In other regions, coordinating organizations can include: the Economic Cooperation Organization (ECO), the Arab Maghreb Union (AMU), AU-IBAR (African Union Interafrican Bureau for Animal Resources), the Southern Africa Development Community (SADC), all of which are committed to controlling transboundary animal and zoonotic diseases (see Appendix 9 for more details). These organizations are very important to the success of the implementation programme for HPAI as they have the mandate and authority to facilitate and conduct sub-regional activities related to trade and socio-economic development. All issues related to harmonization of standards, policies and cross border control and management of animal movement will be discussed and facilitated through these regional organizations. Those countries in Southeast Asia and East Asia that are not members of these two regional organisations will also be able to participate in regional activities directly through FAO and OIE under the umbrella of GF-TADs. It is also expected that the regional organizations will be flexible to include the non-member countries in the regional efforts to control HPAI for mutual benefit.

11.3 International Organizations (FAO, OIE and WHO)

OIE, FAO, in collaboration with WHO will be directly involved in the broad coordination of the global strategy. They have a global mandate to address the issues of animal and zoonotic diseases.

FAO has a global mandate in animal production and health, particularly in the control of transboundary animal diseases, such as FMD and rinderpest eradication (GREP). FAO has also taken a lead in influenza field programs in providing emergency funds for HPAI control in the affected countries (see Appendix 5). FAO has a regional office in Bangkok that provides technical backstopping for the Asian countries. FAO and OIE have established a formal partnership in tackling important transboundary animal diseases under the GF-TADs.

OIE has a mandate to set standards and norms, provide expertise and promote international solidarity for the control of animal diseases. It also plays a leading role in animal production food safety by collaborating with Codex Alimentarius committee. OIE has regional representations in Asia (Tokyo), the America's (Buenos Aires), Middle East (Beirut), East Europe (Sofia) and Africa (Bamako). These OIE Regional Offices are specialised on capacity building of Veterinary Services including private sector component.

WHO has a global mandate to control human diseases, and has a large network of country and regional offices in Asia. Given the global public health significance of HPAI, WHO will be an important partner in developing and implementing disease control strategies to ensure that both the human health and livestock industries are protected.

The international organizations will deploy the expertise of their collaborating centres and reference laboratories, internationally recognized in avian influenza, for specific inputs. In addition, the international organizations will establish partnerships with advanced research institutions.

11.4 National Agriculture Research and Extension Systems (NARES)

Several NARES in Asia and elsewhere have well-developed strengths in livestock health, and in the delivery of disease control programmes. They also have a strong field presence and therefore are natural partners in the activities proposed under the strategy. The Asia Pacific Association for Agriculture Research Institutes (APAARI), which provides a network of all the NARES in the sub-region is also involved in the coordination of agriculture research, may also be able to contribute, particularly in the context of delivery and dissemination of information and data.

A number of NGOs operate at the community level in the sub-region, particularly in delivering animal health technologies. When appropriate, partnerships will be formed with such NGOs.

11.5 Private Sector

Small-scale commercial farmers, large scale poultry producers and the livestock trade are closely interlinked and will play a role in the project planning and implementation stage as their participation and understanding of the poultry sector is important in achieving the objectives of the programme. A number of local and international commercial biological and pharmaceutical companies operate within the sub-region and provide veterinary services. Their role will be important in the context of communication, delivery and supply of standardized vaccines and diagnostics for the support of HPAI control.

12. REQUIRED INVESTMENT

Funding requirements to support the three levels of the global strategy are projected to amount to US\$ 140 million over 3 years (Table 4). The budgets presented are indicative and will be subject to further revisions, subject to the inputs provided by each country during project formulation. Country-specific budget allocation has been categorized into Southeast Asia H5N1 infected (Cambodia, Lao PDR, Viet Nam and Indonesia), South Asia H7/H9-infected (Pakistan), non-infected countries (Myanmar, Philippines, Papua New Guinea, Timor Leste, Bangladesh, Bhutan, India, Maldives, Sri Lanka), immediate response at national level for new countries at risk (Central Asia, Middle East, Eastern Europe and Africa), and in regions with infected countries, such as Central Asia, eastern Europe and the Caucasus, the new regions at risk, the Middle East and Africa. Of the total indicative budget, approximately 72% is

allocated to country-specific activities, 22% to regional activities, and 4% to international activities such as coordination, global epidemiology analysis, tracking and early warning systems and 2 % for investigation and research (see Table 4, pie chart). In addition, a small budget is proposed for the ECTAD programme of FAO and the tracking system of the OIE to verify non official information about the occurrence of animal diseases in the context of the OIE Early Warning System. These two items will constitute less than 3% of the total budget. Country-specific budget allocations were estimated on the basis of the scope of the HPAI problem, the actual need, and the current capacity to absorb the necessary resources. Proportional budget allocation for different activities at country level is presented in Table 4, pie chart. Of total budget, 65% will be earmarked for disease control (laboratory upgrading, field surveillance, biosecurity, and vaccination), 25% for training and capacity building, 5% for institution building such as policy development and socio-economic impact assessment, and 5% to support public awareness programs.

13. RESOURCE MOBILIZATION

Since the outbreak of AI in late 2003 and early 2004 in South East Asia, FAO and a number of donors have provided emergency funds to support the control of HPAI. Over \$18 million have been committed to various country-specific and regional projects in South, Southeast and East Asia. Most of these emergency projects will be coming to an end by the middle to end of 2005. National project proposals have been developed for Cambodia, Lao PDR, Viet Nam, Indonesia and Pakistan. Three sub-regional project proposals have been developed for strengthening coordination networks for the control and prevention of HPAI in East Asia, South East Asia and South Asia. A proposal for a regional network of Centres of Excellence in social, economic and policy analysis of HPAI control has been developed, as well a proposal on support for international, regional, sub-regional and national coordination for the control of HPAI. Proposals for country-specific projects for countries at risk in South East Asia and South Asia have not yet been developed. The total budget for these projects comes to \$102 million

To achieve strategic goals for the newly infected and non-infected regions at risk outside the originally infected Asia regions, project proposals will be developed, beginning with regional TCPs. A Central Asia Concept Note to provide emergency assistance has been prepared at an estimated cost of \$4.5 million over 1.5 years. Project proposals are under development for the six new regions at risk, to provide emergency assistance over the immediate to short term. The total budget for these projects is estimated at \$25-30 million.

FAO and OIE will seek additional donor funds for the above and other initiatives, to build on presently ongoing efforts, to provide medium to long-term support. A number of formal and informal discussions have taken place with bilateral and multilateral donors and funding agencies. The donors that have shown strong interest in supporting the global strategy include EU, the OPEC Fund for International Development, ADB, the World Bank, and the governments of Germany, Netherlands, Australia, Japan and USA (see Table 5).

As a priority, funds are being sought for longer-term support for the five originally infected countries (Cambodia, Lao PDR, Indonesia, Viet Nam and Pakistan). Indonesia ranks high in priority, given the onset of human fatalities and the endemic nature of the disease in that country. The nine non-infected at risk countries in Asia (Myanmar and Philippines in South East Asia and Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka in SA) also urgently need funds for sustained HPAI control and/or for surveillance and emergency preparedness. Following the introduction of HPAI beyond the original Asia regions, additional funds are

being sought for preparedness in six new regions at risk (Central Asia, Middle East, Eastern Europe/Caucasus, North Africa, West Africa and Eastern Africa). Funding will also be sought for the regional support unit and a global facility, given the regional and global significance of the HPAI problem and necessary investigations and research. Such assistance will need to go beyond short-term emergency assistance, and even beyond longer term, 3-year national project support.

Of the affected countries, the Governments of Thailand and PR China, while committed to regional coordination and cooperation, have already developed their country-specific country strategies and plans, and are not currently requesting financial support. In addition, Japan, Malaysia and Republic of Korea, who have eradicated the disease, will be part of the global strategy and members of the regional coordination, but will not require outside financial assistance.

13.1 Source of Funds

Of the \$102.5 million originally targeted for HPAI intervention in Asia, only \$ 25 million has been pledged to date. Currently, funding has been pledged by the Government of Germany to support Cambodia and Lao PDR. The Government of United States has appropriated approximately \$25 million to support FAO and WHO regional activities. Countries likely to be supported include Indonesia, Pakistan and Viet Nam. The Government of Netherlands has provided seed money of \$250,000 and technical support for project formulation for further funding, and has prepared, in conjunction with FAO, a national, 3-year control project for Indonesia. The Governments of Finland and the United States have also pledged assistance to Indonesia. The EU is also consider supporting a mid to long term control programme for Asia.

TABLE 1 - COMPARISON OF THE FIVE TARGETED COUNTRIES FOR HPAI CONTROL IN SOUTH EAST ASIA

Countries	Human population			
	Millions	People/sq km	Per capita income (US\$)	% in urban areas
Lao PDR	6	24	310	20
Cambodia	12	71	280	20
Indonesia	212	117	710	30
Viet Nam	81	247	430	25
Thailand	62	121	1980	40

TABLE 2 - ESTIMATED POPULATION ENGAGED IN BACKYARD POULTRY PRODUCTION IN INFECTED COUNTRIES OF SOUTHEAST ASIA

Countries	Human population			Rural people (millions) dealing with poultry under to assumptions	
	millions	Living in rural areas		60%	80%
		%	No. (millions)		
Lao PDR	6	80	4.8	2.9	3.8
Cambodia	12	80	9.6	5.8	7.7
Indonesia	212	70	148.4	89.0	119.0
Viet Nam	81	75	60.8	36.5	48.6
Thailand	62	60	37.2	22.3	29.7
Total	373		260.8	136.5	208.8

Source: World Development Report 2004

TABLE 3 - CHARACTERISTICS OF FOUR DIFFERENT POULTRY PRODUCTION SYSTEMS

Characteristics Parameter	Poultry Production Systems				
	Industrial and Integrated Production	Commercial poultry production		Village or backyard Production	
		Large Scale	Small-Scale	Poultry	Domestic ducks
Production System	System 1	System 2	System 3	System 4	System 5
Biosecurity	High	Medium	Low	Low	Low
Market outputs	Export and urban	Urban/rural	Live urban/rural	Rural	Rural/Urban
Dependence on market for inputs	High	High	High	Medium	High
Dependence on market access	High	High	High	Medium	Medium
Location	Near capital and major cities	Near capital and major cities	Smaller towns and rural areas	Outdoors	Outdoors
Type of confinement	Indoors	Indoors	Indoors/Part-time outdoors	Not confined	Not confined
Housing	Closed	Closed	Closed/Open	Minimal	None
Contact with other poultry	None	None	Yes		
Contact with domestic ducks	None	None	Yes	Yes	Yes
Contact with other domestic birds	None	None	Yes	Yes	Yes
Contact with wild-life	None	None	Yes	Yes	Yes
Veterinary services	Own Veterinarian	Pays for veterinary service	Pays for veterinary service	Irregular	Irregular
Source of medicine and vaccine	Market	Market	Market	Government, Market	Government, Market
Source of technical information	Company and associates	Sellers of inputs	Sellers of inputs	Govt. extension service	Govt. extension service
Source of financing	Banks and own	Banks and own	Banks and private	Private, occasionally Banks	Private, rarely Banks
Breed of poultry	Commercial	Commercial	Commercial/Indigenous	Indigenous	Native
Food security of owner	High	High	High	Variable	High

TABLE 4: INDICATIVE BUDGET

South, East and South East Asia	US\$/year (millions)	No. of years	TOTAL US\$ (millions)	% of the TOTAL
<i>Country Specific Projects</i>				
Infected Countries H5N1				
Cambodia	1.5	3	4.5	4.4
Lao PDR	1	3	3	2.9
Viet Nam	8	3	24	23.4
Indonesia	7.5	3	22.5	22.0
Infected Country H7/H9				
Pakistan	2.5	3	7.5	7.3
Subtotal			61.5	60
Non-infected countries				
Myanmar, Papua New Guinea, Philippines, Timor Leste	2.5	3	7.5	7.3
Bangladesh, Bhutan, India, Maldives, Sri Lanka	2.5	3	7.5	7.3
Subtotal			15	14.6
<i>Regional/Sub-regional Projects</i>				
Diagnosis and Surveillance SEA	2	3	6	5.9
Diagnosis and Surveillance EA	2	3	6	5.9
Diagnosis and Surveillance SA	2	3	6	5.9
Policy and Economic impact for HPAI	1.5	3	4.5	4.4
Subtotal			22.5	22.0
<i>International Coordination</i>				
GF TADs	1	3	3	2.9
Vaccine trials in ducks	0.5	1	0.5	0.5
Subtotal			3.5	3.4
TOTAL	34.5		102.5	100.0

New Regions at Risk	US\$/year (millions)	No. of years	TOTAL US\$ (millions)	% of the TOTAL
<i>Regional Projects</i>				
Central Asia	4.5	1.5	6.8	17.6
Eastern Europe/Caucasus	5.2	1.5	7.8	20.2
Middle East	4.1	1.5	5.2	13.5
North Africa	2.8	1.5	4.2	10.9
Eastern Africa	5.2	1.5	7.8	20.2

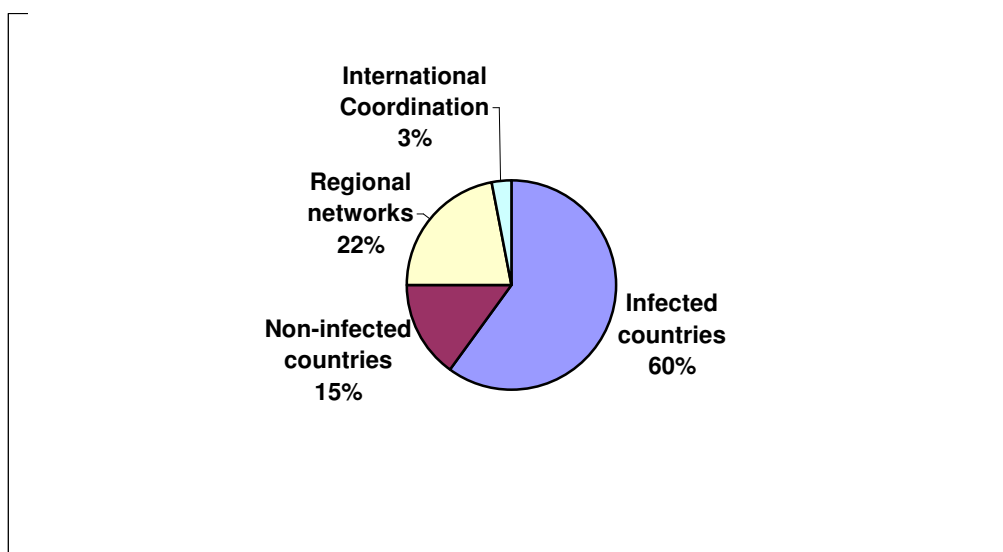
West Africa	4.5	1.5	6.8	17.6
TOTAL	26.3		38.6	100.0
National Components				
Central Asia	3.3	1.5	5.0	
Eastern Europe/Caucasus	4.0	1.5	6.0	
Middle East	2.7	1.5	4.0	
North Africa	2.0	1.5	3.0	
Eastern Africa	4.0	1.5	6.0	
West Africa	3.3	1.5	5.0	
Subtotal	19.3		29.0	
Investigation Components				
Central Asia	0.25	1.5	0.4	
Eastern Europe/Caucasus	0.25	1.5	0.4	
Middle East	0.25	1.5	0.4	
North Africa	0.25	1.5	0.4	
Eastern Africa	0.25	1.5	0.4	
West Africa	0.25	1.5	0.4	
Subtotal	1.5		2.4	
Regional Components				
Central Asia	0.7	1.5	1	
Eastern Europe/Caucasus	0.7	1.5	1	
Middle East	0.3	1.5	0.5	
North Africa	0.3	1.5	0.5	
Eastern Africa	0.7	1.5	1	
West Africa	0.7	1.5	1	
Subtotal	3.4		5	
International Components				
Central Asia	0.25	1.5	0.4	
Eastern Europe/Caucasus	0.3	1.5	0.45	
Middle East	0.2	1.5	0.3	
North Africa	0.15	1.5	0.25	
Eastern Africa	0.3	1.5	0.45	
West Africa	0.25	1.5	0.4	
Subtotal	1.45		2.25	

TABLE 4 cont..

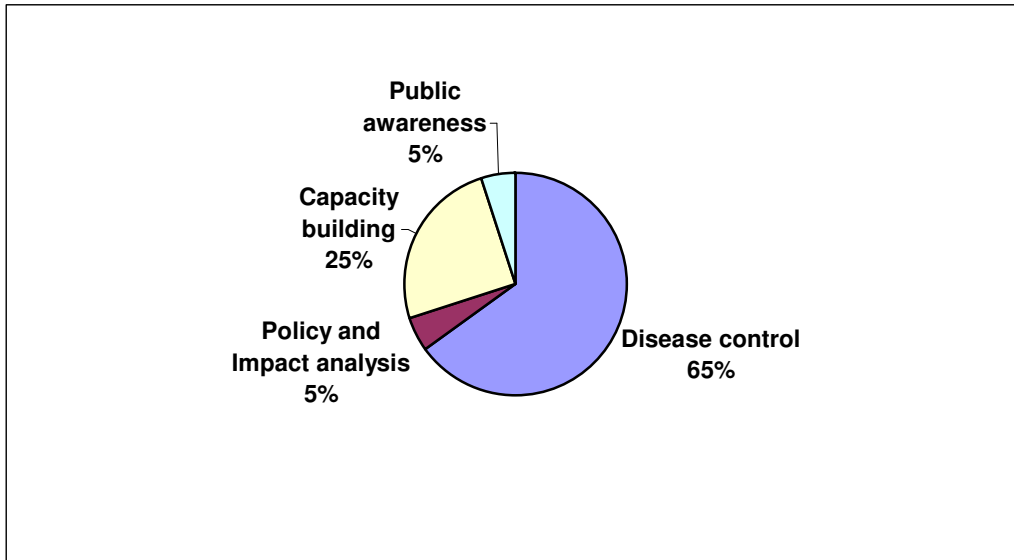
ALLOCATION ACCORDING MAIN PRIORITIES

Priorities for HPAI control in Asia	No. of years	TOTAL US\$ (millions)	% of TOTAL
1. H5N1 Countries	3	54	38.0
2. H7 infected countries	3	7.5	5.3
3. Non-infected countries at risk	3	15	10.6
4. Regional networks	3	22.5	15.8
5. International Coordination	3	3	2.1
6. Vaccine trials in ducks	1	0.5	0.4
7. New regions at risk	1.5	39.6	27.9
TOTAL		142.1	100.0

**Indicative budget for national, regional and international activities
in South, East and Southeast Asia**



Indicative budgets for country specific activities in South, East and Southeast Asia



Indicative budgets for regional projects in the new regions at risk

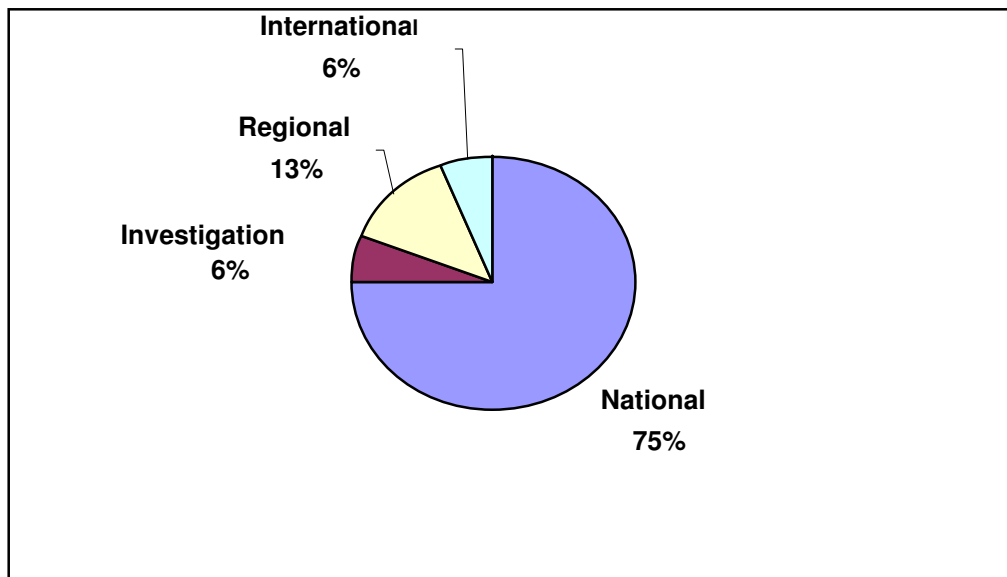


TABLE 5: INDICATIVE FINANCIAL SUPPORT FROM VARIOUS DONORS

Components of the Strategy	Budget US\$ (millions)	Donors and indications to support different components of global HPAI control programme							
		Japan	Germany	Netherlands	EU	USAID	OPEC	ADP	Australia
Country Specific Projects									
<i>South East Asia H5N1 infected</i>									
Cambodia	4.5		x			x			
Lao PDR	3.0		x			x			
Viet Nam	24.0					x			
Indonesia	22.5			x		x			x
<i>South Asia (H7 infected countries)</i>									
Pakistan	7.5								
<i>Non-infected countries at risk</i>									
Myanmar, Philippines, Papua New Guinea, Timor Leste	7.5								
Bangladesh, Bhutan, India, Maldives, Sri Lanka	7.5								
Regional/Sub-regional Networks									
Diagnosis and Surveillance SEA	6.0	x						x	
Diagnosis and Surveillance EA	6.0							x	
Diagnosis and Surveillance SA	6.0							x	
Social, economic and policy analysis (3 sub regions)	4.5							x	
International Coordination							x		
GF-TADs	3.0								
TOTAL	102.0								
		0							
Regional Project									

New Regions at risk									
Central Asia	6.8						x		
Eastern Europe/Caucasus	7.8								
Middle East	5.2						x		
North Africa	4.2								
Eastern Africa	7.8								
West Africa	6.8								
TOTAL	38.6								
GRAND TOTAL	140.6								
Pledges US\$ (millions)		0.6	6.5	TBD ^a	TBD	25	TBD	25	0.2

^a Seed money of 250000 USD already committed to design and development of full projects for further funding.
TBD = to be determined

TABLE 6 - GLOBAL STRATEGY LOGFRAME*

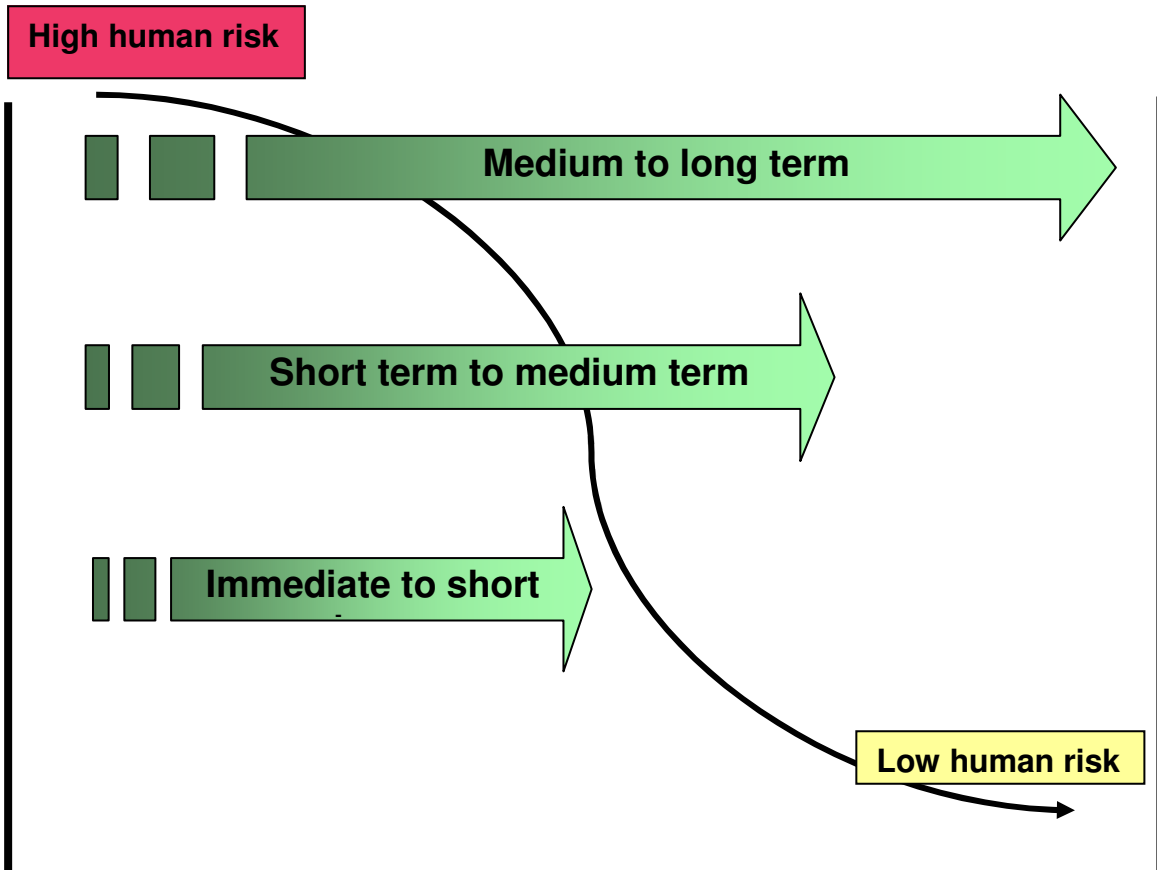
Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
GOAL			
To control and eradicate the highly pathogenic H5N1 avian influenza in chickens from the world.	<ul style="list-style-type: none"> • Improved regional/national policies and regulations adopted to control HPAI • Livestock products certified for exports to OECD 	<ul style="list-style-type: none"> • National livestock policy documents • Participatory poverty reports • Livestock trade data in FAO and WTO reports 	
PURPOSE			
<ul style="list-style-type: none"> • Diminish the global threat of human pandemic, promote healthy poultry production, enhance a robust regional and international trade in poultry and poultry products, increase food safety, and improve the livelihoods of the poor small holder farmers. 	<ul style="list-style-type: none"> • Regional coordination mechanism adopted by participating countries by end-2005 • Animal morbidity and mortality decrease by 50% in selected target zones by 2008 	<ul style="list-style-type: none"> • National livestock policy and disease outbreak reports • OIE and WHO regional reports on diseases • Donor review reports on HPAI 	<ul style="list-style-type: none"> • Target countries remain committed to HPAI control under regionally • Donor support continues • No natural disasters occur
OUTPUTS			
<ul style="list-style-type: none"> • HPAI spread in humans and chickens contained. • HPAI incidence in chickens progressively reduced. • Strategic vaccination of ducks implemented with reduced virus shedding, and reduced incidence in chickens. • Progressive HPAI eradication in all commercial farming systems and zones achieved. • Introduction or establishment of HPAI prevented in non-infected at risk countries. • Emergency preparedness plans developed for all countries in Asia. • National, subregional policies on HPAI control developed and implemented • Enhanced HPAI control capacity developed. • Improved understanding of virus epidemiology. • Risk of human pandemic progressively minimized, and safe trade in poultry reestablished 	<ul style="list-style-type: none"> • 2005 – 2008 • 2006 - 2010 • 2006 - 2015 • 2010 – 2015 • 2006 - 2007 • 2006 - 2007 • 2006 - 2015 • 2006 - 2015 	<ul style="list-style-type: none"> • Quarterly technical, electronic and printed reports and newsletters from each national project. • Project website providing a platform for the regional HPAI information system • Consultant reports • Stakeholder and participant feedback • Project review report • AIDE news • OIE reports 	<ul style="list-style-type: none"> • Affected and at risk countries committed to regional HPAI control • More advanced countries in Asia cooperate and assist those less advanced • Regional cooperation remains strong • Ready access to field sites available • HPAI vaccines in ducks are able to reduce virus shedding.

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
ACTIVITIES			
<ul style="list-style-type: none"> • Develop and implement national HPAI control programs for all infected countries. • Establish Regional Coordination Mechanism for HPAI control. • Establish Networks on diagnosis and surveillance, and policy and economic impact assessment. • Establish International Facility of HPAI control. • Evaluate vaccine efficacy in ducks • Study the epidemiology of HPAI • Revise HPAI control programs as necessary. • Provide training in HPAI control methods, including in diagnosis, surveillance, disease information, economic impact, project management. • Develop appropriate national and regional policies and regulations on HPAI control. 	<ul style="list-style-type: none"> • Infected countries start implementing disease control programmes. • MOU signed by the member countries of the respective regional organizations • Coordinator for HPAI facility recruited. • Targeted disease control strategy developed based on epidemiological information and field vaccination trials in ducks. • National and regional labs established. • National teams (taskforce) of trained personnel involved in HPAI control. • Policies and regulations endorsed by member countries. 	<ul style="list-style-type: none"> • Various reports as above • Official MOUs • ‘Standards’ document adopted by GMS countries • Regional Disease information reports through networks • Quarterly project reports • Implementing agencies progress reports • FAO’s project review reports 	<ul style="list-style-type: none"> • Appropriate experts recruited in time • Participating countries set up national project offices in time • Governments are politically committed to providing facilities and staff to support HPAI control. • Regional organizations participate in the HPAI control. • Funding is available
INPUTS			
<ul style="list-style-type: none"> • Country HPAI projects • Regional HPAI Support Units • International HPAI Facility 	<ul style="list-style-type: none"> • \$ 76,500,000 • \$ 22,500,000 • \$ 3,000,000 • \$ 102,000,000 	Multi-donor funding committed following submission of detailed projects plans	Donors willing to fund a long term strategy to control HPAI

* This table will be updated according to the evolution of the situation

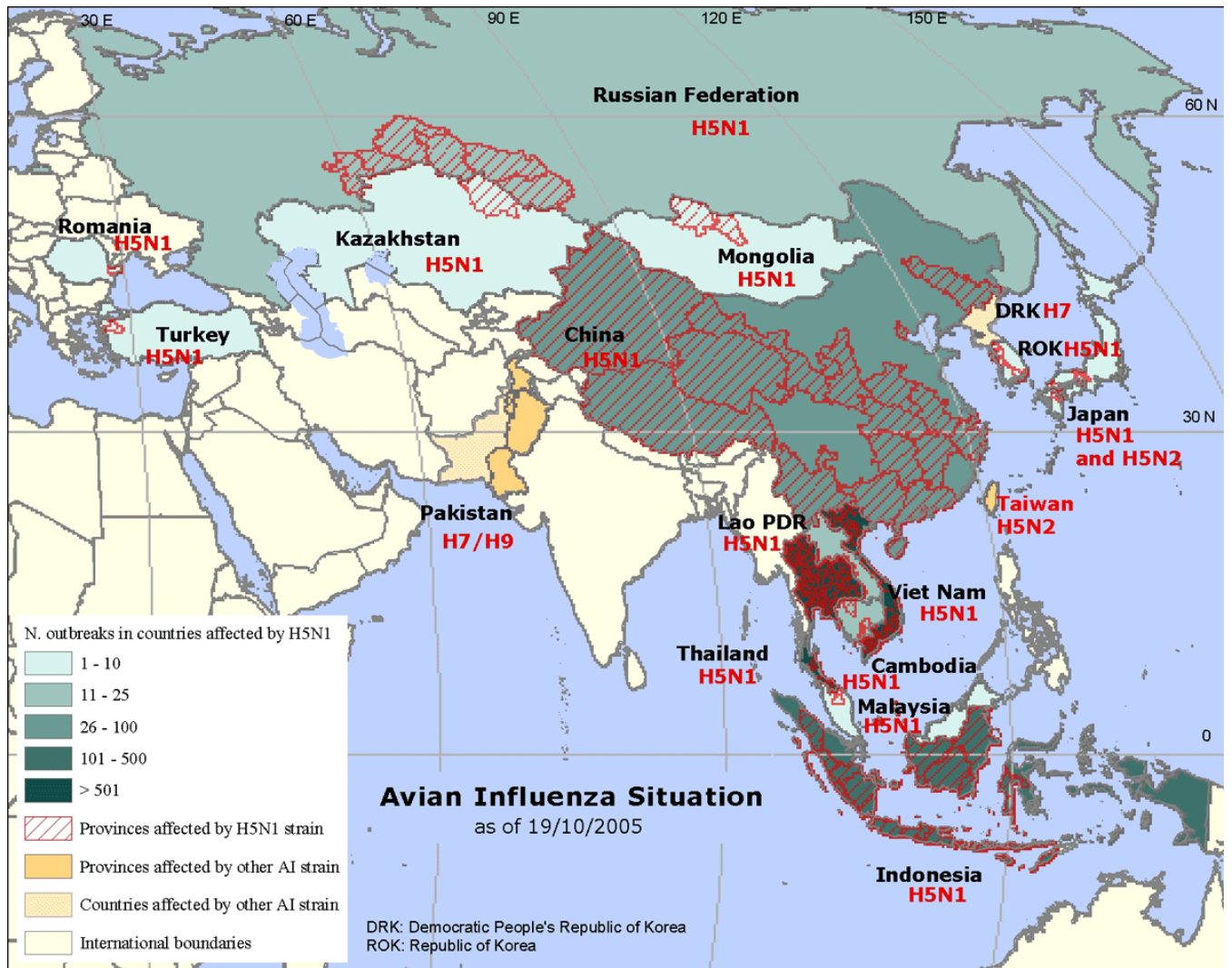
FIGURE 1

Conceptual framework for HPAI control



Progressive disease control pathway in the infected countries

FIGURE 2 - HPAI SITUATION BETWEEN 2004 AND 2005

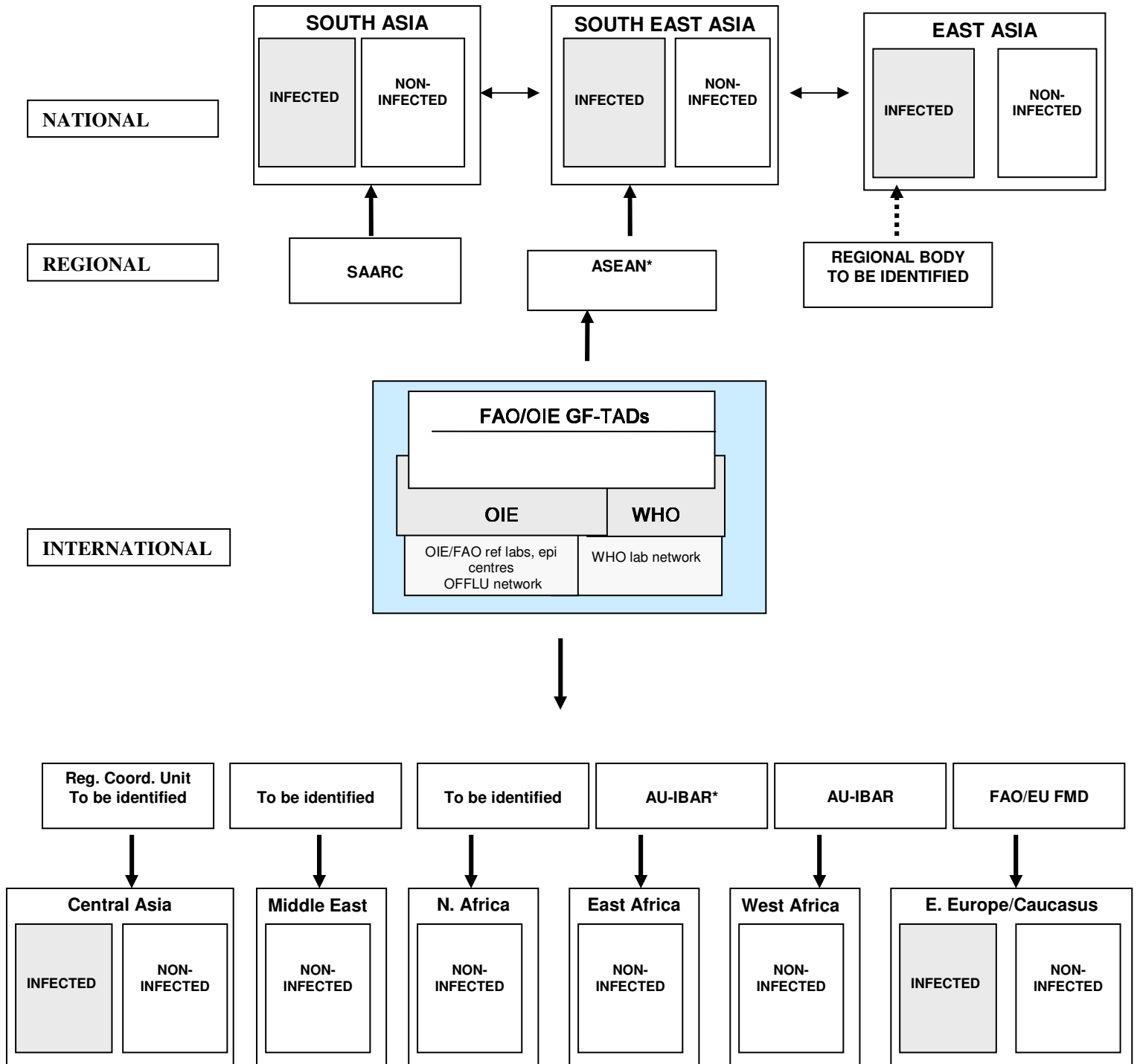


NUMBER OF HUMAN CASES AND FATALITIES (WHO 4 May 2005)

Country/ Territory	Total cases	Deaths
Cambodia	4	4
Thailand	17	12
Viet Nam	91	41
Indonesia	5	3
Total	117	60

FIGURE 3 - FRAMEWORK FOR IMPLEMENTATION

(* Some Regional Organizations already have specialized programmes or groups working on the control of various transboundary diseases, such as ASEAN (Sectoral Working Group on Livestock, ASEAN HPAI Task Force, Southeast Foot and Mouth Disease programme) or IBAR (Pan African Control of Epizootics) which could serve as models)



APPENDIX 1 - The Global Framework for the Progressive Control of Transboundary Animal Diseases (TADs)¹

Executive Summary

The Global Framework for Progressive Control of Transboundary Animal Diseases (GF-TADs) is a joint FAO/OIE initiative, which combines the strengths of both organisations to achieve agreed common objectives. GF-TADs is a facilitating mechanism which will endeavour to empower regional alliances in the fight against transboundary animal diseases (TADs), to provide for capacity building and to assist in establishing programmes for the specific control of certain TADs based on regional priorities.

Devastating economic losses to livestock farmers the world over from major outbreaks of transboundary animal diseases (TADs) such as foot-and-mouth disease (FMD; 1997-2003), classical swine fever in the Caribbean and Europe (1996-2002), rinderpest in the Somali ecosystem (2001), peste des petits ruminants in India and Bangladesh, contagious bovine pleuropneumonia in Zambia, Angola, Namibia and Eritrea in 2000-2003, as well as Rift Valley fever in the Arabian Peninsula (2000) were the main stimulus for the initiative to create a Global Framework for Progressive Control Transboundary Animal Diseases. In early 2004, the reporting of Highly Pathogenic Avian Influenza (HPAI) virus throughout 10 Asian countries, with mortalities in exposed humans, underlines the pressing need for improvement of disease management at its inception before TADs spreads to devastating proportions and early detection, reporting and reaction. Several international fora and institutions have emphasised the need to prevent and control TADs due to their strong impact on livestock agriculture, trade and food security. The World Food Summit (1996), the International Committee of the World Organisation for Animal Health (OIE, 2002), the 31st Session of the FAO Conference (2001), and the World Food Summit: five years later (WFS:fy1, 2002) all recognised the widespread and increasing impact of epidemic animal diseases like FMD, and stressed the need to combine efforts to combat the disease at the national, regional and international level involving all relevant stakeholders. There is ample evidence from various studies that the spread of TADs will increase unless a concerted international action is put into place for effective prevention and progressive control, as currently shown in the HPAI outbreak that FAO, OIE, and WHO are attempting to contain with their available resources. This conclusion is predominantly based on predictions of an unprecedented growth of the livestock sector and of the consumption of livestock products, particularly in TAD-endemic developing countries. The predicted livestock sector growth is expected to take place in tropical and sub-tropical zones, with trends towards larger farm units and more intensive, often industrial production, and with strong increase in trade of livestock and livestock products through informal and formal markets regionally and internationally. Even prior to the current HPAI crisis, FAO and OIE have examined the problem of transboundary animal diseases from the perspective of the complexity of environment, market access, food chain and human welfare, as well as considering the international public good goals of Social Equality, Sustainability of Natural Resources Use, and Veterinary Public Health. Thus the GF-TADs proposes the effective prevention and progressive control of major TADs as an effective contribution to the achievement of the Millennium Development Goals by providing assistance and guidance to member countries through existing regional specialised organisations and their regional representation offices. To achieve this objective, it is suggested that focused efforts for the control of the major TADs must be at the source of infection and prior to the spread of the disease. The GF-TADs programme will be developed along four main thrusts:

- A regionally led mechanism, to operationally address and implement action against priority diseases as agreed by relevant stakeholders;
- The development of Regional and Global Early Warning Systems for major animal diseases;
- The enabling and application of research on TADs causing agents at the molecular and ecological levels for more effective strategic disease management and control; and,
- The completion of the Global Rinderpest Eradication Programme² set for achieving global declaration of freedom by the year 2010.

¹ Transboundary animal diseases are defined as: those that are of significant economic, trade and/or food security importance for a considerable number of countries; which can easily spread to other countries and reach epidemic proportions; and where control/management, including exclusion, requires cooperation between several countries.

The Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs)

Version approved as basic text the 24 May 2004 by FAO and OIE – page 4/38

The Outputs and Outcomes for the six-year programme (2004-2009) are:

- Country-based surveillance and disease reporting enhanced through capacity building of epidemiology units and of laboratory personnel.
- Concerted animal disease control programmes developed through the establishment of regional support units within ongoing regional specialised organisations and/or Regional Commissions. These regional support units will be in a position to assist in the direction of animal disease surveillance, and to provide mechanisms to meet specific regional needs.
- Regional and Global Early Warning Systems for TADs established with the collaboration of FAO, OIE and WHO, connected to regional epidemiological systems.
- Internationally verified global freedom from rinderpest - The Global Rinderpest Eradication Programme, GREP secured.
- Animal populations where primary endemic circulation of FMD and other selected TADs occur identified and characterised.
- International, regional, and national early response capacities for prompt and authoritative disease diagnosis and for targeted local disease control to limit the spread of new outbreaks of TADs established.
- Referral diagnostic and molecular biological capacity of OIE-FAO Reference Laboratories and Collaborating Centres strengthened and technology transfer provided to National Agricultural Research Systems (NARS), primarily through the established system of networks of national and Regional laboratories supported by the FAO/IAEA Joint Division and through North-South/South-South laboratory partnerships including the network of OIE-FAO reference laboratories.
- Assistance in the development of TAD research programmes provided through FAO and OIE Collaborating Centres and other advanced research institutes (ARIs) as appropriate.

2 Rinderpest – also known as cattle plague - once a disease that expanded from Mauritania to Indonesia and from Europe to southern Africa (with one outbreak each in Brazil and Australia) is now likely to be limited to a small primary endemic area known as the Somali pastoral ecosystem. Global eradication is planned for 2010. This major and unique undertaking of global eradication of an animal disease offers learning opportunity for good disease management practices in general.

APPENDIX 2 - HPAI VIRUS IN ASIA: TECHNICAL INFORMATION

Highly Pathogenic Avian influenza (HPAI), also known as fowl plague, is a disease of birds causing huge morbidity and mortality. It is caused by infection with influenza A viruses of the family Orthomyxoviridae. Of the three influenza virus types (A, B and C), only the type A is responsible for fowl plague. Many bird species, including wild and aquatic birds have been known to be infected by influenza A viruses, but the majority of the virus isolates are of low pathogenicity for chickens and turkeys, the main birds of economic importance. Influenza A viruses have several subtypes classified on the basis of their haemagglutinin (H) and neuraminidase (N) antigens. At present 15 H subtypes and 9 N subtypes are recognised. The highly virulent viruses causing huge losses have only been associated with H5 and H7 subtypes. However, not all H5 and H7 subtypes are virulent. The virus is known to genetically evolve rapidly causing antigenic drift and the potential to generate new virulent subtypes. Recent epidemics of HPAI in South East Asia have demonstrated the rapidity with which it can spread and destroy the poultry industry. Over 100 million birds have been either killed or destroyed and a number of human beings have died of the disease. The virus has the potential to cause catastrophic human pandemics if it mutates into a form that transmits rapidly between humans. The HPAI has spread in vast areas of South East Asia and it will take a few years before the disease is eradicated in domestic poultry. In the meantime the disease will continue to pose a serious threat to commercial and smallholder poultry sector in the sub-region and a serious risk to those countries in the sub-region that are free of the disease.

Diagnosis

The virus can be identified by inoculating suspensions of infected material into embryonated fowl eggs. The allantoic fluid from inoculated eggs after an incubation period of 4-7 days can be tested for haemagglutinating activity. The presence of influenza A viruses can be confirmed by immunodiffusion test between the isolated virus and an antiserum to the nucleocapsid or matrix antigen. Alternatively, an RT-PCR test can be used with appropriate set of primers to identify the virus. Influenza A virus can be sub-typed using mono-specific antisera prepared against the isolated antigens of each of the 15 H and 9 N subtypes in immunodiffusion tests. Alternatively isolated viruses can be subjected to haemagglutination and neuraminidase inhibition tests against a battery of polyclonal antisera covering all the subtypes. Since not all H5 and H7 viruses are virulent, the isolated virus can also be tested for pathogenicity through inoculation into susceptible birds. Serological tests such as AGID and ELISAs are also available to detect antibodies to influenza A type specific antigens.

Vaccines

Highly efficacious inactivated oil-emulsion vaccines as well as recombinant vaccine delivered through fowl pox virus against H5 and H7 subtypes are commercially available but are only recommended under exceptional and time-bound situations. For example, the international organisations recommended the use of inactivated vaccines against HPAI in the recent epidemics in countries where export was not a major priority and the disease had spread extensively into the smallholder poultry farming systems. The vaccine is currently used in some countries in conjunction with the application of culling and high biosecurity procedures to eradicate the disease.

Evolution of HPAI/H5N1 virus in East and Southeast Asia

Until the 2005 outbreak in Asia it was understood that to facilitate the emergence of HPAI, a population of susceptible avian hosts needs to be present in which LPAI viruses can multiply. This has been the case in all major outbreaks in Europe and the Americas, where a number of different strains of avian influenza have caused serious mortality.

However, the evolution of HPAI/H5N1 virus in East and Southeast Asia has taken a slightly different course. Retrospective analysis of disease outbreaks caused by the H5N1 strain show that the virus, first identified in wild geese in 1996 in Guangdong Province in PR China, adapted itself over a relatively short period to the domestic domestic duck population. The virus then spread rapidly in the large (660 million) domestic duck population in PR China, causing little or no disease symptoms. By 2004, it was estimated that infected waterfowl were excreting virus for as long as 17 days following infection, causing a huge contamination of the environment. This process is regarded as one of the key factors leading to the huge number of outbreaks in the Region.

While the gene pool of the avian influenza viruses is relatively benign in its natural wildlife host population, it tends to evolve rapidly into pathogenic strains in domestic poultry. Available evidence points at causal factors such as the changing population size and structure of poultry industry in response to increasing consumer demand, expansion of virus from its traditional host range to domestic ducks and terrestrial poultry, and the wide geographical spread through the live-bird trade. The widespread circulation of HPAI/H5N1 in domestic ducks and terrestrial poultry has resulted in the selection of a more aggressive Z genotype with the Z+ strain infective to humans spreading to Thailand, Viet Nam and more recently to Cambodia. This spill-over process into domes-

ticated poultry and humans presents a clear and present danger to the global poultry industry and public health. Therefore, the rapid evolution of the virus necessitates a comprehensive global approach linked to adequate capacity in disease surveillance, an early-warning response, for all countries affected, regionally and internationally.

The 1997 H5N1 outbreak in Hong Kong SAR, which killed 6 of the 18 people infected, originated from an H5N1 strain isolated from geese in 1996 in Guangdong Province. The virus has since been continually, and relatively rapidly, changing genetically and in its host range, particularly finding a niche in domestic ducks. This adaptation, together with the peculiar nature of farming system in the region is considered to have contributed significantly to increased HPAI cases.

The following chronological events based on disease outbreaks, and characterization of virus isolates from both normal and sick and dead birds prior to the explosive outbreaks and spread of the disease in Southeast Asia in 2004 serve to highlight the situation:

- The first detection of H5N1 virus occurred in geese in the Guangdong Province of PR China in 1996, hence the designation of the virus Geese/GD/96. No known precursor of this H5N1 has been detected but it is believed to have originated from low pathogenic avian influenza viruses circulation in PR China during that period.
- The H5N1 viruses have been found in farmed domestic ducks and live bird markets since 1997. The first evidence of H5N1 virus causing serious disease in both terrestrial poultry and human beings came from outbreaks that occurred in Hong Kong SAR during 1997. This genotype appears to have emerged from of a reassortment of genes from several avian influenza viruses circulating in PR China at the time and included H9N2 and H6N1 viruses from quail and teal, respectively.
- Before the current crisis, outbreaks of disease due to H5N1 viruses have been few and limited to Hong Kong SAR (1997, 2001, 2002 and 2003).
- Between 1997 and 2003 a genetically heterogeneous population of H5N1 viruses emerged in domestic water fowl. While before 1999, HPAI viruses were rarely detected in domestic ducks, the genetic changes to viruses from this time onwards appear to have led to an expansion of host range to both domestic and wild waterfowls.
- Between 2001 and 2004 a genetically heterogeneous population of H5N1 viruses also emerged in terrestrial poultry in Southern PR China and Hong Kong SAR.
- During this period, the majority of the viruses detected and characterized belonged to the genotype that is now referred to as the 'Z' genotype, which has now become dominant in the region.
- Thus between 1996 and 2004, from among the vast genetic pool of avian influenza viruses in South and East Asia, a genetically heterogeneous population of highly pathogenic H5N1 influenza viruses has emerged that displays variable phenotypic characteristic, particularly in its infectivity and pathogenicity to domestic ducks.

APPENDIX 3 - ECONOMIC IMPACTS OF HPAI IN SOME SOUTH EAST ASIAN COUNTRIES

Thailand is the only poultry-producing country in the Region with a substantial regional and international export orientation. According to Oxford Economic Forecasting, in 2004, the total GDP losses accruing from poultry farm losses in Thailand, the fourth largest poultry-exporting country in the world prior to the HPAI outbreaks was \$1.2 billion. Export bans on poultry have severely damaged the industry, together with its suppliers: hatcheries, feed mills farm workers and traders. Furthermore, Thailand has suffered substantial human fatalities. Thailand's veterinary services systems has risen to the enormous task of controlling the epidemic and is now in the process, through active surveillance and disease mapping, to identify hot spots for final eradication.

In **Viet Nam**, 58 out of 64 Provinces were affected by the first 2004 outbreak, and 17% of 261 million national flocks were destroyed. Direct losses were estimated to be over \$200 million. The number of rural households directly involved in poultry production, predominantly carried out by women, has halved. The Government has been proactive in dealing with the outbreaks and has, supported by a World Bank emergency HPAI control project, begun to strengthen diagnostic and surveillance, prepare policy studies on compensation and poultry sector restructuring, instituted stringent biosecurity measures, and initiated a public awareness campaign. A multi-ministerial steering committee meets regularly in close coordination with WHO, the World Bank and other international organizations. However, consumer confidence in consuming poultry remains low and poultry prices have dropped, adding additional financial hardship on large and small-scale producers.

In **Indonesia** 15 out of 30 Provinces were affected with the destruction of some 16 million birds. Direct losses are estimated at over \$170 million. The greatest loss was among the backyard village farmers, estimated at 30 million households keeping 200 million chickens. An estimated 23% of industrial and commercial farm workers lost their jobs and 40% of these were unable to find alternative employment. Given the small scale of problem in Cambodia and Lao PDR, where the commercial poultry sector is small, the economic damage was small.

Lao PDR and Cambodia have experience a relatively low incidence of HPAI/H1N1 outbreaks, although their smallholder sectors were hard hit and there have been fatalities in Cambodia. Weak veterinary services in both countries have failed to bring the infection under control and the disease has now become endemic, with sporadic outbreaks. Controlling or eradicating HPAI from both countries plays an important part in the overall strategy for Southeast Asia, as these countries form a natural boundary between Thailand and Viet Nam and southern PR China, thereby preventing transboundary progression.

Pakistan is the only infected country with HPAI in South Asia, and has had endemic problem with the HPAI/H7N3 strain for several years. The local poultry industry is geared predominantly to home consumption. Of the total population of 156 million, over 40 million people are poor, living predominantly in rural areas supported by subsistence farming system. While HPAI in Pakistan has not been directly linked with the outbreaks in Southeast Asia, it is important to note that the disease causes high mortality and poses a potential threat to its rapidly expanding livestock industry.

APPENDIX 4 – VACCINATION FOR HPAI

HPAI VACCINES

*(Reproduced from the OIE Terrestrial Manual, version adopted May 2005,
The complete Terrestrial Manual can be found on www.oie.int)*

Experimental work has shown, for both notifiable avian influenza (NAI) and low pathogenic avian influenza (LPAI) that vaccination protects against clinical signs and mortality, reduces virus shedding and increases resistance to infection, protects from diverse field viruses within the same hemagglutinin subtype, protects from low and high challenge exposure, and reduces contact transmission of challenge virus. However, the virus is still able to infect and replicate in clinically healthy vaccinated birds. In some countries, vaccines designed to contain or prevent NAI are specifically banned or discouraged by government agencies because it has been considered that they may interfere with stamping-out control policies. However, most AI control regulations reserve the right to use vaccines in emergencies.

It is important that vaccination alone is not considered the solution to the control of NAI or LPAI subtypes if eradication is the desired result. Without the application of monitoring systems, strict biosecurity and depopulation in the face of infection, there is the possibility that these viruses could become endemic in vaccinated poultry populations. Long-term circulation of the virus in a vaccinated population may result in both antigenic and genetic changes in the virus and this has been reported to have occurred in Mexico.

Live conventional influenza vaccines against any subtype are not recommended.

– Conventional vaccines

Conventionally, vaccines that have been used against NAI or LPAI have been prepared from infective allantoic fluid inactivated by beta-propiolactone or formalin and emulsified with mineral oil.

The existence of a large number of virus subtypes, together with the known variation of different strains within a subtype, pose serious problems when selecting strains to produce influenza vaccines, especially for LPAI. In addition, some isolates do not grow to a sufficiently high titre to produce adequately potent vaccines without costly prior concentration. While some vaccination strategies have been to produce autogenous vaccines, i.e. prepared from isolates specifically involved in an epizootic, others have been to use vaccines prepared from viruses possessing the same haemagglutinin subtype that yield high concentrations of antigen. In the USA, some standardisation of the latter has been carried out in that the Center for Veterinary Biologics have propagated and hold influenza viruses of several subtypes for use as seed virus in the preparation of inactivated vaccines.

Since the 1970s in the USA, there has been some use of inactivated vaccines produced under special licence on a commercial basis. These vaccines have been used primarily in turkeys against viruses that are not highly pathogenic, but which may cause serious problems, especially in exacerbating circumstances. Significant quantities of vaccine have been used. Conventional vaccination against the prevailing strain of LPAI has also been used in Italy for a number of years. Vaccination against H9N2 infections has been used in Pakistan, Iran and the People's Republic of China.

Inactivated vaccine was prepared from the LPNAI virus of H7N3 subtype responsible for a series of outbreaks in turkeys in Utah in 1995 and used, with other measures, to bring the outbreaks under control. Similarly in Connecticut in 2003 vaccination of recovered hens and replacement pullets with a H7N2 or H7N3 vaccine was implemented following an outbreak of LPNAI caused by a H7N2 virus.

Vaccination against HPNAI of H5N2 subtype was used in Mexico following outbreaks in 1994–1995, and against H7N3 subtype in Pakistan following outbreaks in 1995. In Mexico, the HPNAI virus appears to have been eradicated, but LPNAI virus of H5N2 has continued to circulate, while

in Pakistan highly pathogenic AI viruses genetically close to the original highly pathogenic AI virus were still being isolated in 2001 and 2004. Following the outbreaks of HPNAI caused by H5N1 virus in Hong Kong in 2002 a vaccination policy was adopted there using an H5N2 vaccine. In 2004 the widespread outbreaks of highly pathogenic AI H5N1 in some countries of South-East Asia resulted in prophylactic vaccination being used in the People's Republic of China and Indonesia. Prophylactic vaccination has also been used in limited areas in Italy to aid the control of H5 and H7 LANAI viruses.

– **Recombinant vaccines**

Recombinant vaccines for AI viruses have been produced by inserting the gene coding for the influenza virus haemagglutinin into a live virus vector and using this recombinant virus to immunise poultry against AI. Recombinant live vector vaccines have several advantages: [1] they are live vaccines able to induce both humoral and cellular immunity, [2] they can be administered to young birds and induce an early protection, e.g. the fowl poxvirus can be administered at 1 day of age, is compatible with the Marek's disease vaccine, and provides significant protection 1 week later, [3] they enable differentiation between infected and vaccinated birds, since, for example, they do not induce the production of antibodies against the nucleoprotein or matrix antigens that are common to all AI viruses. Therefore, only field-infected birds will exhibit antibodies in the AGID test or ELISA tests directed towards the detection of influenza group A (nucleoprotein and/or matrix) antibodies. However, these vaccines have limitations in that they will replicate poorly and induce only partial protective immunity in birds that have had field exposure to or vaccination with the vector virus, i.e. fowl poxvirus or infectious laryngotracheitis viruses for currently available recombinant vaccines. If used in day-old or young birds the effect of maternal antibodies to the vector virus on vaccine efficacy may vary with the vector type. In the case of fowl poxvirus recombinant vaccine, it has been reported that effective immunisation was achieved when given to 1-day-old chicks with varying levels of maternal immunity. However, when very high levels of maternal antibodies are anticipated due to previous infection or vaccination, the efficacy of the fowlpox vector vaccine in such day-old chicks should be confirmed. In addition, because the vectors are live viruses that may have a restricted host range (for example infectious laryngotracheitis virus does not replicate in turkeys) the use of these vaccines must be restricted to species in which efficacy has been demonstrated.

The use of recombinant vaccines is restricted to countries in which they are licensed and are legally available. The recombinant fowlpox-AI-H5 vaccine is licensed in El Salvador, Guatemala, Mexico and the USA. Recombinant fowl poxvirus vaccines containing H5 HA have been prepared and evaluated in field trials, but the only field experience with this vaccine has been in Mexico, El Salvador and Guatemala where it has been used in the vaccination campaign against the H5N2 virus. Between 1995 and 2001, Mexico used more than 1.423 billion doses of inactivated H5N2 vaccine in their H5N2 control programme. In addition, Mexico, Guatemala and El Salvador have used over 1 billion doses of the recombinant fowlpox-AI-H5 vaccine for control of H5N2 LPNAI from 1997 to 2003.

– **Other novel vaccines**

A baculovirus-expression system has been used to produce recombinant H5 and H7 antigens for incorporation into vaccines.

DNA encoding H5 haemagglutinin has been evaluated as a potential vaccine in poultry.

– **Detection of infection in vaccinated flocks and vaccinated birds**

A strategy that allows 'differentiation of infected from vaccinated animals' (DIVA), has been put forward as a possible solution for the eventual eradication of NAI without involving mass culling of birds and the consequent economic damage that would do, especially in developing countries. This strategy has the benefits of vaccination (less virus in the environment), but the ability to identify infected flocks would still allow the implementation of other control measures, including stamping out. At the flock level, a simple method is to regularly monitor sentinel birds left unvaccinated in

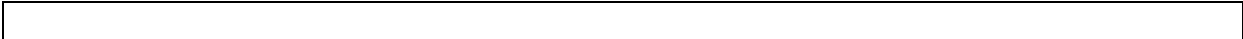
each vaccinated flock, but this approach does have some management problems, particularly in identifying the sentinels in large flocks. As an alternative or adjunct system, testing for field exposure may be performed on the vaccinated birds. In order to achieve this, vaccination systems that enable the detection of field exposure in vaccinated populations should be used. Several systems have been developed in recent years. These include the use of a vaccine containing a virus of the same haemagglutinin (H) subtype but a different neuraminidase (N) from the field virus. Antibodies to the N of the field virus act as natural markers of infection. This system has been used in Italy following the re-emergence of a LPNAI H7N1 virus in 2000. In order to supplement direct control measures, a 'DIVA' strategy was implemented using a vaccine containing H7N3 to combat an H7N1 field infection. Vaccinated and field exposed birds were differentiated using a serological test to detect specific anti-N antibodies. The same strategy was used to control LPNAI caused by H7N3 in Italy in 2002–2003, in this case with an H7N1 vaccine. In both cases vaccination with stamping out using this DIVA strategy resulted in eradication of the field virus. Problems with this system would arise if a field virus emerges that has a different N antigen to the existing field virus or if subtypes with different N antigens are already circulating in the field.

Alternatively the use of vaccines that contain only HA, e.g. recombinant vaccines, allows classical AGID and NP- or matrix-based ELISAs to be used to detect infection in vaccinated birds. For inactivated vaccines, a test that detects antibodies to the nonstructural virus protein has been described (52). This system is yet to be validated in the field.

– **Production of conventional vaccines**

The information below is based primarily on the experiences in the USA and the guidance and policy for licensing avian influenza vaccines in that country (53). The basic principles for producing vaccines, particularly inactivated vaccines, are common to several viruses e.g. Newcastle disease.

The vaccine production facility should operate under the appropriate biosecurity procedures and practices. If HPNAI virus is used for vaccine production or for vaccine–challenge studies that part of the facility where this work is done should meet the requirements for Containment Group 4 pathogens.



APPENDIX 5 - CURRENT FAO AND OTHER DONOR EMERGENCY ASSISTANCE*

Recipient countries (As of 14/10/05)

Cambodia

Donors	Amount (US\$)	Description
FAO TCP	\$387,075	TCP/CMB/3002 Emergency assistance for the control of avian influenza
ADB**	\$91,940	Non-Trust Fund, under general coordination of FAO (for training, equipment and public awareness activities)
Australia	\$50,000	AusAID through FAO Trust Fund (OSRO/CMB/402/AUL)
	\$156,250 (A\$200,000)	Strengthening surveillance and response capacities for Avian Influenza through WHO Cambodia
China	\$50,000	Direct contribution to government (no details given)
France	\$53,480	French Cooperation through FAO Trust Fund (OSRO/CMB/403/FRA)
Germany	\$50,000	GTZ through FAO Trust Fund (OSRO/CMB/401/GER)
Japan	\$56,000	Non-Trust Fund, grant assistance for grass-roots human security project for antiviral medicines & equipment
WHO	\$3,000	PPE supplies/training, lab training for DAHPs investigating teams and Human Flu Vaccine purchase.

China

Donor	Amount (US\$)	Description
FAO TCP	\$387,097	TCP/CPR/3004 Emergency assistance for the control of avian influenza
Australia	\$377,324 (A\$500,000)	WHO China: strengthening preparedness for potential influenza pandemics and to develop early warning and response capacity to deal with emerging public health threats.

DPRK

Donor	Amount (US\$)	Description
FAO TCP	\$218,000	TCP/DRK/3006 Emergency assistance for the control and prevention of avian influenza
Australia	\$192,000	OSRO/DRK/503/AUL Australian emergency assistance for the control and prevention of avian influenza in the Democratic People's Republic of Korea
	\$192,000	Through WHO: To help DPRK respond to Avian Influenza.

Indonesia

Donors	Amount (US\$)	Description
FAO TCP	\$388,170	TCP/INS/3001 Emergency assistance for the control of avian influenza
Australia	\$2,597,657 (A\$3,325,000)	Human health protection, antiviral supplies through WHO
		Provide training (2 virologists) in AAHL, Geelong, Australia
		- technical assistance, training, strengthening surveillance and response capacities through WHO Indonesia
		- dispatch 3 epidemiologists working with the Disease Investigation Center's staff members to assist the surveillance action plan
		- dispatch 1 virologist for bench training in DIC R-III, R-IV and R-VI (18 vets and assistants)
		- Provide training (2 field veterinarians) on HPAI in AVA, Singapore
		50,000 courses of anti-flu medication Tamiflu
	\$7,546,486 (A\$10,000,000)	To improve response to a potential outbreak in key areas: detection; diagnosis; and containment of the virus; public awareness-raising and information-sharing.
China	\$100,000	Vaccines, training, public awareness at off farm
Germany	\$60,692	OSRO/INS/402/GER through FAO Trust Fund. Four trainings on clinical & gross pathology diagnosis (total 222 veterinarians)
Japan	\$78,906	MAFF provided protective gear through grass roots aid fund
	\$113,000	Public awareness campaign activities
	\$10,000	Through JICA/Indonesia on diagnostic training (24 veterinarians)
		Expert team to provide advice on counter-measures
Netherlands	€89,000	May provide veterinary experts in support of FAO operations.
		The cooperation plan HPAI Indonesia 2005 (development of coping strategy, Monitoring and surveillance)
USA		Support through the provision of laboratory analysis available in Atlanta
World Bank		- avian influenza workshop in Bengkulu - training for field officers & farmers on clinical signs, vaccination & biosecurity measures in Bengkulu (3 districts)
Canada	\$12,682,844 (C\$15,000,000)	To strengthen the human health sector in emerging infection disease (for over five years period). All via MoH/WHO under New Emerging Infectious Diseases Programme, and as regional project.
Republic of Korea	In kind	-Instant AI test kits for farmer's usage

Lao PDR

Donors	Amount (US\$)	Description
FAO TCP	\$384,125	TCP/LAO/3001 Emergency assistance for the control of avian influenza
ADB	\$50,000	Direct procurement of Personnel, Protective clothing and equipment
Australia		Through AusAID to invite two government veterinarian for training course
China	\$50,000	Re-establishing poultry breeding farms
France	\$53,000	For surveillance activities (OSRO/LAO/401/FRA)
Japan	\$50,000	Through JICA
	\$33,758	MoHLW through WHO
USA	\$250,000	Direct contribution to WHO Regional Office (Manila)
WHO		Support for one veterinarian for a 2 month mission
	\$11,050	In kind donation from WPRO
UK	\$500,000	Department of Health has provided assistance for 2005/06.

Mongolia

Donors	Amount (US\$)	Description
FAO		Sent expert on wildfowl study

Pakistan

Donors	Amount (US\$)	Description
FAO TCP	\$387,370	TCP/PAK/3002 Emergency assistance for the control of avian influenza
China	\$50,000	For strengthening the diagnostic/samples analysis capacities of the national labs.

Thailand

Donor	Amount (US\$)	Description
FAO		Technical advice of experts
Japan		Experts & standard Antigen/reagents to assist avian influenza typing/sub-typing.

Viet Nam

Donors	Amount (US\$)	Description
FAO TCP	\$387,979	TCP/VIE/3003 Emergency assistance for the control of avian influenza
ADB*	\$50,000	Protective gear
EC	\$968,000	Protective clothing, lab equipment
Germany	\$60,000	laboratory diagnostic equipment
Luxembourg	\$60,142 (€ 50,000)	Early warning system in Viet Nam.
Japan	\$200,000	Tamiflu (anti-viral drug)
	\$1.800.000	Japanese Social Development Fund (JSDF) to assist vulnerable households and strengthen community based early warning through the World Bank AIERP project
WHO		Unspecified in-kind support
World Bank	\$170,000	Formulation mission for Avian Influenza Emergency Recovery Project
	\$5,000,000	Avian Influenza Emergency Recovery Project (AIERP) for strengthening disease surveillance and diagnostic capacity; strengthening the poultry sector infrastructure to better cope with serious disease outbreaks; and safeguarding human health by improving public awareness and information
Denmark	nearly \$130,000	Through DANIDA, in kind cooperation for avian influenza control in 14 provinces (sprayers, protective clothing, diagnostic kits for local veterinarians)
	more than \$300,000	in kind cooperation of veterinary equipment (automatic cylinders, ice-boxes, antiseptic chemicals and protective clothes)
AFD		Assessment mission to support the HPAI situation in Viet Nam and to provide recommendations for short and long term by Agence Française de Développement (AFD), Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) and Vétérinaires Sans Frontières (VSF) was funded by AFD
Republic of Korea	\$30,000	to study measures to prevent and control bird flu
China		(Province of Taiwan) donated 600,000 tablets of Tamiflu

Regional

Donor	Amount (US\$)	Description
Japan	\$1,610,083	MoFA through FAO Trust Fund for CMB, INS, LAO and VIE (OSRO/RAS/401/JPN)
Australia	\$781,250	Strengthening the operations of the WHO Global Outbreak Alert and Response Network
	\$390,625 (A\$500,000)	Experts in epidemiology, animal health, virology, laboratory and public health to address Avian Influenza outbreaks; equipment/consumables through WHO WPRO
	\$117,188	Enabling technical support and the provision of essential supplies to address Avian Influenza

	(A\$150,000)	enza (diagnostic kits and PPE) for East Timor, Thailand and Myanmar through WHO SEARO
	\$273,438 (A\$350,000)	Responding to the epidemiological and diagnostic needs arising from the Avian Influenza outbreak at Australian Animal Health Laboratory (AAHL), Geelong
	\$507,813 (A\$650,000)	ASEAN-Australia Development Cooperation Program (regional capacity building to deal with infectious disease outbreaks)
	\$56,598 (A\$75,000)	DAFF: providing workshops and training to promote sharing of information, lessons, and advice to help facilitate more efficient and effective responses to Avian Influenza for Indonesia, East Timor and South Pacific participants.
	\$3,906,250 (A\$5million)	Strengthening the regions ability to identify and respond to outbreaks of emerging and resurging zoonotic diseases through WHO WPRO, ASEAN Secretariat and DAFF
	\$565,986 (A\$750,000)	DoHA: establishing and managing a regional network of Australian epidemiologists based in Indonesia, Vietnam and China.
	\$4,527,891 (A\$6 million)	To strengthen the capacity of a number of East Asian countries to identify and respond to outbreaks of Avian Influenza and related diseases. (three years)
Netherlands	\$ 250,000	OSRO/INT/501/NET for ECTAD (with additional in-kind expert assistance)
FAO TCP	\$384,231	TCP/RAS/3004 Emergency regional coordination assistance for control of avian influenza in southeast Asia
	\$394,668	TCP/RAS/3006 Diagnostic Laboratory and Surveillance Network Coordination for Control and Prevention of Avian Influenza in Southeast Asia
	\$395,502	TCP/RAS/3007 Diagnostic laboratory and surveillance network coordination for control and prevention of avian influenza in East Asia
	\$394,444	TCP/RAS/3008 Diagnostic laboratory and surveillance network coordination for control and prevention of avian influenza in South Asia
	\$398,307	TCP/RAS/3010 Emergency regional support for post-avian influenza rehabilitation
	\$350,000	TCP/RAS/3014 Strengthening avian influenza control through improved transboundary animal disease information management system in Asia
USA	\$6,000,000	Immediate assistance for strengthening community-based early warning and early reaction to Avian Influenza outbreaks in Cambodia, Indonesia, Lao PDR, PR China and Viet Nam (OSRO/RAS/505/USA)
	\$5,500,000	CDC is starting an initiative to improve influenza surveillance in Asia.
	\$1,250,000	The US Agency for International Development (USAID) has set aside \$1,250,000 for Avian Influenza, including \$300,000 for WHO to increase international coordination to improve disease control and surveillance and \$250,000 towards the procurement of personal protective equipment (PPE). (Cambodia, Thailand, Laos, Vietnam, and Indonesia)

EMPRES / Supra-Regional

Donor	Amount (US\$)	Description
FAO TCP	\$370,052	TCP/INT/3010 EMPRES Emergency Centre for Transboundary Animal Disease operations (ECTAD) – Coordination

* To be updated according to the information received from donors (more investment to come according to the evolution of the situation)

** Asian Development Bank

APPENDIX 6 – COUNTRY PROFILES OF HPAI

H5N1 infected countries

Thailand has an advanced country strategy document and disease control plans. Although Thailand has not requested any financial support, it is an active member of the regional and international cooperation for the HPAI control. The country has made great strides in controlling the disease through continuous improvement in its infrastructure, diagnostics and surveillance capacity and has also provided regional support to other poorer countries in the region.

Thailand was, ahead of the HPAI crisis, the world's fourth largest poultry exporting country, and its strategy for the long term control of the disease is very much determined by its efforts for restoring its export opportunities. Thailand is also the country with the second largest number of human fatalities from HPAI. Strengthening human public health and public awareness therefore ranks high on Thailand's HPAI control agenda. Thailand's poultry sector is extremely diverse, ranging from vast, integrated layer and broiler farms with state of the art management and equipment, to small holder farming systems in the delta and highland zones. The intermingling of large domestic duck and rural poultry populations, together with commercial and backyard pig rearing, poses a continuous risk of HPAI spill-over.

Viet Nam has an advanced national strategy document which needs to be supported by detailed disease control programme, and is, to date, the only regional country that has designed an HPAI emergency recovery project financed by the World Bank/IDA, with technical support funding from FAO and the Japan Social Development Fund (JSDF). FAO has been supporting the Government of Viet Nam in developing this control programme. Viet Nam has decided to move on vaccination to control the disease. Viet Nam is also preparing strategy papers on national compensation policy, poultry sector restructuring, emergency preparedness, and is strengthening its veterinary services system. A newly built Virus Reference Laboratory will commence HPAI virus characterization work with the highest number of human cases recorded so far, Viet Nam will continue to need external support. Current estimates are that the country will need approximately \$7.5 million per year for three years to provide the necessary infrastructure and manpower to control and prevent the spread of the disease.

Cambodia and Lao PDR

Both countries are mountainous, with relatively low population and poultry densities. Veterinary services are weak, and challenged by difficult road and communication infrastructure. Both countries require significant assistance in strengthening their veterinary services, laboratory capacity, surveillance, human capacity building, and epidemiology and disease information systems. Both countries have predominantly smallholder farming systems, so that the impact of HPAI falls mainly on the rural poor. Cambodia has had four human cases of HPAI in the latest (2005) wave of outbreak influenza. This has underlined the weakness in surveillance capability. Even though HPAI incidence in both countries is low and their poultry sectors largely subsistence-based, the control of HPAI is important in the overall regional strategy. By creating a disease-free buffer zone between Thailand and Viet Nam, future disease outbreaks in either Viet Nam or Thailand can be kept apart. Cross-border traffic between Cambodia and Viet Nam is known to introduce infected poultry, and border controls need to be further strengthened.

Indonesia

The unfortunate impact of the tsunami late 2004 has forced the country to divert its focus on this immediate human disaster. However, the country needs urgently to develop its national disease control strategy and control programme.

The disease has spread widely in many islands, mainly to southern Sumatra and Sulawesi, Java and Bali. While the disease incidence has been brought down substantially by vaccination, major gaps remain in the understanding of the epidemiology of HPAI in the country. The recent human deaths revealed still weak disease management and biosecurity level. A potential advantage is that the many islands of Indonesia's archipelago form natural barriers to the spread of disease, even though trans-island traffic is voluminous and not always well guarded. Furthermore, the recently completed decentralization of Indonesia's Districts and Subdistrict levels from the Central Government, allowing the former to set policy and manage public sector budget independently from Jakarta, has fragmented the national-provincial flow of disease information and their control programmes. This institutional constraint hampers effective, rapid alert and response.

Indonesia's smallholder farming system, predominantly typified by sector 4 and 5 poultry systems, has made it difficult to apply effective culling and biosecurity measures. This has induced the country to undertake mass vaccination to control the high-mortality disease in the smallholder farming systems. Recent molecular analysis of the various strains of H5N1 would provide further aid in disease control planning. The control of HPAI in

Indonesia is also to assist in eliminating/reducing the HPAI threat to the Australian continent, Malaysia and the Philippines. Therefore, the control of the disease in the country is of strategic regional importance.

China, Mongolia, Russian Federation, Kazakhstan, Romania, Turkey and their neighbouring areas

Deaths of wild birds due to the HPAI H5N1 were reported in Qinghai Lake, China in May 2005, and subsequently the disease spread in Russia, Kazakhstan and Mongolia (Central Asia). It seems that the virus has moved north and westward along the wildfowl flyway and has spread to domestic poultry whenever there is a chance because of weak biosecurity level of some farms and smallholders. The veterinary structure exists, but in some countries diagnosis capacity is needed to be strengthened. As of 13 October, the disease has reached to Turkey and Romania (Eastern Europe and Caucasus). Since wild birds are difficult to control, the major emphasis must be given on enhancing biosecurity at smallholder level and promoting people's awareness.

Countries with H7, H9 virus (Pakistan)

Pakistan has been affected by the H7 and H9 strains of the avian influenza virus for a number of years. The disease outbreaks reported in the country last year appear unrelated to the simultaneous H5N1 related outbreaks in Southeast Asia. However, the country is threatened by an equally highly pathogenic avian influenza virus strain H7N3. While the disease is presently under control, Pakistan will require additional assistance in strengthening its diagnostic capacity, and vaccine production facilities. Country strategy and detailed control plans still need to be developed.

Non-infected but at risk countries in South, Southeast and East Asia

Currently the non-infected at risk countries can be divided into countries that were previously infected but have stamped out the disease, and those that have never been infected. The former group of countries includes Hong Kong SAR, Japan, Malaysia, and the Republic of Korea. The success of their stamping out of the disease was greatly dependent on the availability of adequate financial resources and ability to provide good veterinary infrastructure to implement biosecurity measures and surveillance programmes. In March 2005, the Democratic People's Republic of Korea, previously never infected had HPAI outbreaks due to H7N7 strain in three well-managed farms. The disease has now been stamped out but the situation in the smallholder sector requires further clarification.

Of the countries that have been never reported include in Southeast Asia (Brunei, Myanmar, Papua New Guinea, Singapore, Timor Leste and Philippines,) and South Asia (Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka), many of these countries do not have the necessary financial resources and the level of veterinary services to support stamping out policy and maintain high level of surveillance to either prevent the introduction and establishment of infection.

Non-infected but new countries at risk in Central Asia, Middle East, Caucasus Europe and Africa

Areas along the wildfowl flyways are at risk. However, few information is available on the role of various migrating species is transporting virus across regions. To prevent further spreading of H5N1 enhanced surveillance, early reporting and emergency preparedness plans are highly necessary. Research on virus transmission mechanism is also needed. Veterinary structure must be strengthened in the countries in these regions so as to find and contain an outbreak at early stage effectively. Well trained Veterinary Services with quick reporting-commanding system is required for to undertake this task. The laboratory diagnosis capacity must be strengthened as well. A strong emphasis must be given on enhancing biosecurity at smallholder level.

Non-infected countries in Americas

Currently countries in Americas have less risk than the countries in the Eurasian-African Continents and Australia. Nevertheless, the countries should have a good Veterinary structure to find and contain an outbreak at early stage effectively. The laboratory diagnosis capacity must be in place to support the disease control. A strong emphasis must be given on educating farmers on biosecurity.

Thus, resources will be targeted to these countries to improve active risk-based surveillance programmes, better emergency preparedness plans and facilities to stamp out the disease.

The strategy will also ensure that the direct disease control efforts will be enhanced by the development of appropriate national and regional policies on management and restriction of live animal movement, compensation of removed stock, disease reporting requirements and long term planning to readjust poultry systems and industry in the Region so as to prevent any further risks of HPAI.

**APPENDIX 7 - KEY COMPONENTS OF THE STRATEGY
INDICATIVE ACTIVITIES AT THREE DIFFERENT LEVELS
OF STRATEGY IMPLEMENTATION IN SOUTH, EAST AND SOUTH EAST ASIA**

National projects

- Policy framework to support control
- Strategic vaccination
- Veterinary capacity building
- Programme management training
- Socio-economic impact
- Risk-based surveillance programmes
- Eradication at source of infection
- Epidemiology-driven disease control
- Policy/protocol/SOPs when seropositive results occur.
- Private sector involvement.
- National disease information systems to network regional concerns.
- Poultry sector restructuring.
 1. Each country is encouraged to think of how its poultry sector should go in 5-10 years time. Questions like: Poultry profile – commercial vs. smallholder, how many companies are involved?
 2. Should countries define their restructuring policies/mechanisms depending on the poultry sector they have?
 - a. Some countries have a significant duck population spread over rice paddy fields.
 - b. Some countries have a big commercial poultry production sector that influences government policy
 - c. Still there are countries with a large scavenging poultry population with no export markets at all.
 3. If restructuring is pursued, what assistance or incentives can government give to raisers to undertake this? This will depend on the country vision on their poultry industry.
 4. Restructuring schemes: licensing poultry enterprises for a certain time period, decreasing production of ducks by halting hatching, relocating the poultry farms to areas with less poultry population density, separating the poultry population from pig farms thru good biosecurity measures.
 5. While the production systems of countries are of the mixed type, the concept of separating the poultry population from pig farms as well as from duck farms should be considered without drastically disrupting social systems.
- Community-based early warning networks.

Regional/Sub-regional level

- Sound disease control programmes for SEA, EA and SA Regions.
- Sub-regional training disease in diagnosis, epidemiology and disease information.
- Regional policy and regulatory framework harmonization.
- Capacity building in socio-economic impact assessment
- Strengthening regional networking.
- Strategic and technical exchange meetings.
- Information collecting and sharing information.

Regional Network - Disease diagnosis and surveillance

- Strengthen diagnostic capacity of regional laboratories
- Build epidemiology capacity to strengthen science-based disease detection.
- Establish epidemiology information exchange networks.
- Develop collaboration between technical centers of OIE, FAO and WHO.
- Facilitate sharing and exchange of virus strains with WHO
- Strengthen veterinary public health services.
- Develop regional communication strategy to support effective implementation of the HPAI control programmes.

Regional Network - Policy and socio-economic impact assessment

- Information sharing between national policy makers, analysts and economist.
- Policy and legislation development
- Socio-economic impact analysis on livelihoods and human health.
- Trade impact and poultry sector issues, such as zoning, compartmentalization, vaccination, export, movement bans.

Policy issues in disease control

- Developing and legislating national HPAI control policies.
- Legalising and controlling vaccination in ducks and other domestic poultry.
- Zoning and compartmentalization to create disease-free zones
- Biosecurity measures in the transport and marketing of poultry.
- Biosecurity and transport control in and around live-poultry markets
- Developing equitable compensation policies (direct or indirect).
- Methods for the humane destruction of poultry and disposal of carcasses.
- Regional disease information sharing.
- Socio-economic impact assessments of HPAI control policies

Indicative activities in capacity building

- Veterinary capacity building.
- Programme management training of supervisory project staff.
- Training community-based disease early warning workers at the village level.
- Engage private poultry sector in providing services to smallholders.
- Awareness training in regulatory, public health and biosecurity measures.
- Project sustainability through long term funding based on results

International Collaboration

- Strengthen linkages among FAO, OIE and WHO in developing HPAI control plans.
- Develop partnerships with other international centres and organizations.
- Coordinate the subregional networks.
- Develop global disease intelligence to support control strategies.
- Monitor trends in global, regional and local poultry markets and their impact on disease control strategies.
- Consolidate international information on HPAI and other TADs.
- Advise and share information with member countries.
- Mobilize donor support.
- Communicate with donors, countries at risk and organizations
- Coordinate strategic research with other international agencies and advanced research institutions to support HPAI control.
- Backstop the regional networks with information, advice and consultation.

**INDICATIVE ACTIVITIES
OF STRATEGY IMPLEMENTATION FOR THE SIX REGIONAL PROJECTS IN
NEW INFECTED AND INFECTED COUNTRIES IN CENTRAL ASIA, MIDDLE
EAST, EASTERN EUROPE/CAUCUSES AND AFRICA**

<p><i>National Response</i></p> <ul style="list-style-type: none"> • Emergency preparedness and Surveillance, including <ul style="list-style-type: none"> • public awareness and communication strategy • grassroots early warning networks • field surveillance • bottom-up information feedback • contingency planning • Strengthening of diagnostic capacity and laboratory support, including <ul style="list-style-type: none"> • risk assessment of national diagnostic capabilities and needs assessment of human and physical resources • laboratory upgrading through training and provision of laboratory consumables for serological and virus detection of HPAI • liaison with international reference laboratories for H5 subtyping, research institutes and agencies (WHO, OIE, others) • Emergency response, including <ul style="list-style-type: none"> • preparation for stamping out and biosecurity • possible vaccination plans • compensation policy and strategy
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<p><i>Regional/Sub-regional coordination</i></p> <ul style="list-style-type: none"> • establishment of coordination units. • strengthening sub regional networks for disease surveillance, diagnosis and information • strengthening sub-regional network for policy development and economic impact assessment

<p><i>International Collaboration</i></p> <ul style="list-style-type: none"> • Strengthen linkages among FAO, OIE and WHO in developing HPAI control plans. • Develop partnerships with other international centres and organizations. • Coordinate the subregional networks. • Develop global disease intelligence to support control strategies. • Monitor trends in global, regional and local poultry markets and their impact on disease control strategies. • Consolidate international information on HPAI and other TADs. • Advise and share information with member countries. • Mobilize donor support. • Communicate with donors, countries at risk and organizations • Coordinate strategic research with other international agencies and advanced research institutions to support HPAI control. • Backstop the regional networks with information, advice and consultation.
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<p><i>Investigation into wildlife</i></p> <ul style="list-style-type: none"> • Precise determination of migratory patterns of wild birds • Range of wild bird species carrying the H5N1 virus • Epidemiological studies

APPENDIX 8

OIE/FAO International Scientific Conference on Avian Influenza, OIE Paris, France, 7–8 April 2005 RECOMMENDATIONS

CONSIDERING THAT:

1. Preventing the spread of pathogens through international trade in animals and animal products is one of the primary missions of the World Organisation for Animal Health (OIE). This is accomplished by establishing and updating international standards and guidelines that prevent spread of pathogens while avoiding unjustified sanitary barriers,
2. The OIE works in close association with FAO in helping countries implement such standards and guidelines,
3. The FAO has as its foremost mission to alleviate poverty through the promotion of sustainable agricultural production, food security and safe and wholesome food products on the market places, and response to crises caused by animal diseases including zoonoses. This is particularly relevant to the FAO priority programme EMPRES (Emergency Prevention System for the Prevention of Plant and Animal Pests and Diseases), and specifically to the Emergency Centre for Transboundary Animal Diseases (ECTAD),
4. The OIE standards for terrestrial animals are contained in the *Terrestrial Animal Health Code* (the *Terrestrial Code*) and the *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals* (the *Terrestrial Manual*),
5. The collection, analysis and dissemination of veterinary scientific information is also one of the main missions of the OIE. Comprehensive analysis of agro-ecological factors, production parameters, and demographics, including animal census, as done at FAO provides additional understanding in disease occurrences and offers opportunities to develop strategic intervention measures,
6. The standards developed by the OIE are recognised as international standards for animal health and zoonoses by the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) of the World Trade Organization (WTO); and serves as a partner with the FAO/WHO Codex Alimentarius on animal production food safety. Implementation of these standards by Member Countries also has benefits for public health (including food safety) and improvement of animal production,
7. Infectious animal diseases and zoonoses such as highly pathogenic avian influenza (HPAI) represent a major constraint to efficient poultry production and regional and international exchanges, present a threat to the livelihood of farmers especially in developing countries, to public health, and to national economies,
8. During the past few years, the world has witnessed the emergence of a severe avian influenza epidemic that has had a major impact on animal health and the potential for serious human health outcomes. This has severely affected the economies of developed as well as developing countries,
9. FAO emergency implementation of some 19 projects at national, regional, and supra-regional level for HPAI prevention, control, and eradication is recognised and has improved the current outlook, with the publication of Guiding Principles for Surveillance and Recommendations taking into account OIE standards, supported by WHO and the donor community,
10. Recent research has confirmed that certain aquatic birds (particularly domestic ducks) can act as reservoirs of infection for HPAI H5N1 with or without clinical signs and are capable of excreting viruses in the environment,
11. Many of the countries infected or threatened by AI are under-resourced and lack the capacity of Veterinary Services for an effective early detection and response to the epidemic in poultry,
12. New scientific and technological knowledge for the prevention and control of AI will contribute to the development of safer and more efficacious measures for the final control and eradication of the disease,
13. For ethical reasons, it is no longer considered acceptable to control and eradicate diseases mainly by applying mass killing of animals,
14. Safe and effective vaccines, if used appropriately, can help improve animal health, public health, animal welfare, and agricultural sustainability; to protect the environment, maintain biodiversity, and protect consumers of animal products,
15. The OIE, has incorporated wherever possible into its standards and guidelines the most up-to-date scientific knowledge on the use of appropriate diagnostic tests, and disease prevention and control methods including vaccination, and has reviewed, commented, and endorsed the FAO Recommendations for the Control of HPAI in Asia,
16. Recent scientific advances in the diagnostic field, in particular the possibility to differentiate vaccinated animals from infected animals, have been recently incorporated into the *Terrestrial Manual*. Their implications have either already been reflected in the review of the *Terrestrial Code* for disease control using appropriate vaccination and for recovery of disease free status after occurrence of a disease,

17. The Conference has provided an opportunity for the exchange of the latest scientific information at the global level that will, at the same time, assist in the evaluation and improvement of the current OIE standards and FAO guidelines for better control of avian influenza and safety of regional and international trade of poultry and poultry products, implementation of strategies, and requirements for effective disease management,
18. For this event, the OIE/FAO have acted in collaboration with WHO, with which a long and valuable tradition for confronting zoonotic diseases exists,
19. There is a need to harmonise communication on risk assessment and risk management,
20. FAO has underlined the links and risks between farming systems, market chains, socio-economic status, and epidemiology of HPAI in Asia, indicating that multidisciplinary approaches are required to adequately tackle the epidemic in poultry and prevent infection spread to humans,
21. It is necessary to protect human health by controlling the disease as a matter of priority at source, i.e. on farms and markets. It is essential to provide national and international support for the improvement of the efficiency of Veterinary Services for that purpose,
22. Long-term prevention and control of AI need to be compatible with social, economic and technical considerations,
23. Effective AI prevention and control require actions from local, national, regional, and international levels,
24. The recently renewed agreement between OIE and FAO has led to synergistic approaches to fight transboundary animal diseases, particularly through the joint initiative GF-TADs,
25. Research into better tools (diagnostics, vaccines, anti-virals, adjuvants, disinfectants, for instance) and virus dynamics (excretion, pathogenesis, virulence genes) will assist in developing control strategies and prevention measures, better epidemiological studies in the country where the disease prevails.
26. The role of wild birds in spread of HPAI H5N1 viruses remains unresolved. Circumstantial evidence suggests limited local infection of resident wild birds, but transfer of H5N1 HPAI viruses outside the outbreak zones by migratory birds has not been substantiated.

CONFERENCE ATTENDEES OF THE OIE/FAO INTERNATIONAL SCIENTIFIC CONFERENCE ON AVIAN INFLUENZA RECOMMEND THE FOLLOWING:

Session 1: Ecology and Epidemiology

1. To prevent the spread of AI viruses to unaffected area/countries from infected area/countries.
2. Country/regional specific studies should be conducted to establish the ecology and epidemiology of the AI virus in reservoir and spill-over species of poultry for the purpose of developing control programmes to stop virus cycling and re-infection.
3. Surveillance and epidemiological studies in migratory and resident wild birds should be conducted to assess the role of wild birds in the maintenance and dissemination of HPAI viruses.
4. Develop sustainable risk-based surveillance programmes for poultry for early identification of AI virus transfer from reservoir species to agricultural systems in order to know if and which AI viruses are present in poultry and develop rapid mitigation and elimination strategies, if required.
5. Encourage national laboratories to join multi-national and international laboratory networks to share AI virus isolates, data and expertise in order to understand AI virus ecology and develop effective control strategies.
6. Support pathogenesis studies in alternatively farmed birds (e.g. ostriches, waterfowl, pheasants, etc.), including an assessment of their role as intermediate hosts for transfer of AI viruses from wild birds to traditionally farmed poultry species, and their potential role for supporting mutation of H5 and H7 LPAI to HPAI viruses.

Session 2: Pathogenesis

1. Country authorities should be made aware of different clinical syndromes in different hosts caused by infection by HPAI viruses as atypical disease signs have been seen in infections with recent isolates.
2. Specific genes from virus isolates should be monitored for evidence of assortments and drift that may contribute to changes in virulence.
3. Surveillance of birds for the presence of H9N2 viruses with the potential to infect mammals should be done.
4. Consideration should be given to conduct monitoring of pigs at risk from infection with AI viruses with the potential to transmit to humans.
5. Investigate the pathogenesis and epidemiology of avian influenza viruses in different species of birds and mammals under the coordination of the joint OIE/FAO network with the support of the OIE/FAO Reference Laboratories for AI.
6. Specific research be conducted on AI surveillance and vaccination in farmed ducks.

Session 3: Human health implications

- 1 Further epidemiological studies at the human-animal interface as well as applied and basic research on H5N1 and other AI viruses with potential human health implication should be conducted urgently and by collaboration between the animal OIE/FAO network and the human WHO network.
- 2 Coordinated research programs must involve veterinary, public health and industry sectors. Safe and efficacious human and avian vaccines should be developed as a priority.
- 3 Veterinary and Public health services should work together to improve national, regional and global health security. Public health services should support the agriculture sector/veterinary services in order to control and eliminate the disease at source and to protect farmers and workers from animal infection in the most efficient and efficacious manner.
- 4 Veterinary and Public health services should strengthen joint activities for surveillance of AI at the human/animal interface. Animal virus isolates and sequence information should be swiftly exchanged between the international reference laboratories of OIE-FAO and those of WHO.
- 5 FAO, OIE and WHO should collaborate with their Member States in the development of appropriate strategies for effective inter-sectoral collaboration during and between crises associated with the emergence of zoonoses.

Session 4: Diagnostics

1. OIE/FAO assist countries in enhancing their veterinary infrastructures to meet the current and future needs for early detection, surveillance and control programmes for avian influenza.
2. OIE/FAO encourage countries/regions to develop a laboratory network that would facilitate the local testing of specimens to decrease turn-around time for diagnostic test results while increasing overall testing capacity. This network should be coordinated through the newly established OIE/FAO network (OFFLU) that could recommend appropriate testing methods, provide training to laboratory personnel, supply quality reagents, and collaborate with OIE/FAO Reference Laboratories.
3. OIE/FAO encourage development of training programmes for laboratory personnel to ensure that appropriate diagnostic tests are used, that test results are interpreted correctly, and that appropriate quality assurance programmes are being used.
4. OIE/FAO encourage development of rapid, sensitive, and cost-effective diagnostic tests that have been properly field validated according to OIE guidelines and appropriate for use in local laboratories involved in the diagnosis of avian influenza.
5. OIE/FAO develop a prototype Material Transfer Agreement (MTA) that could be used by laboratories to facilitate the transfer of viruses to reference laboratories for epidemiologic/research purposes.

Session 5: Control of AI (with focus on vaccination)

1. Infections with HPAI viruses be controlled at source, through implementation of risk reduction interventions, including improved biosecurity, stamping out, vaccination, and education awareness.
2. Donors should give priority to reinforce Veterinary Services and animal health infrastructures in countries infected or threaten by AI.
3. Vaccination should only be used in conjunction with monitoring of vaccinated flocks to ensure efficacy, proper use of the vaccine and absence of virus circulation.
4. Vaccines should comply with OIE standards and vaccination strategies should be consistent with guidelines developed by FAO, and of proven efficacy under experimental and local field conditions.
5. Vaccine delivery systems and vaccination campaigns should be carefully organised and monitored by Veterinary Services.
6. That, wherever appropriate, a surveillance system capable of differentiating infected from vaccinated birds (e.g. DIVA) be applied (including use of sentinel birds when possible).
7. That surveillance programmes be defined before vaccination is introduced. Equally, an exit strategy has to be identified.
8. That strategies be developed and evaluated in statistically based field trials for the appropriate use of vaccination in different epidemiological scenarios throughout the world

Session 6: Improvement of Management Tools

1. A master plan be prepared for the control and prevention of HPAI in Asia, with regional and international coordination;
2. Adequate financial resources be invested to the control of HPAI in Asia, which is currently estimated at between 100 and 120 million USD over a 3–5 year period
3. The meeting strongly recommends that OIE and FAO implement activities of the joint global OIE/FAO network of expertise for avian influenza as soon as possible.
4. The existing FAO regional networks for surveillance and diagnosis be sustained in a long term run.
5. **The FAO/OIE Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) initiatives be used as a foundation for the regional approach to the control and eradi-**

cate AI. The mandates and missions of international and regional organizations be harmonized to avoid gaps and overlapping.

6. Strategies are needed for financing sustainable, concrete action at local level. This is likely to include support for restocking or compensation for losses and should also encompass education on safe poultry keeping and development of appropriate infrastructure and services.
7. National and regional strategies for AI prevention and control should include a careful assessment of the social and economic impact of proposed measures, including the impact on the wider rural economy of changes in the poultry sector. Options for long-term strategies for restructuring of the sectors be previously considered and the possible negative socio-economic impacts on small and medium holders be evaluated as well as the options and cost for mitigation strategies.
8. That, when a decision is made to kill infected or at-risk birds, birds should be humanely destroyed and disposed of along with dead poultry following OIE standards. In the case of HPAI infections, the birds should not be allowed to enter the human food chain or be fed directly or indirectly to other animals including zoo animals.
9. That the OIE International Committee adopts the proposed new surveillance guidelines on AI during the 73rd General Session.
10. That the efficacy of risk reduction and prevention procedures be monitored through targeted surveillance activities, including:
 - post-vaccination surveillance to measure efficacy of vaccination,
 - early identification of virus circulation,
 - monitoring of genetic drift and emergence of new strains
 - monitoring of reservoirs.
11. That the concept of compartmentalisation be recognised as an additional tool in the control of AI and in the facilitation of safe international trade, subject to the effective implementation of the relevant control measures.
12. That the OIE International Committee adopts the proposed revised *Terrestrial Code* chapter on AI that incorporates the concept of compartmentalisation and that provides risk-based recommendations for trade in live poultry, genetic material and products for human consumption. It also encourages transparency in disease reporting, by limiting trade consequences to situations of significant risk.
13. That the OIE and FAO continue to provide practical advice to Member Countries on the establishment and monitoring of compartments, through additional guidelines.
14. That OIE Member Countries implement the new OIE standards including surveillance guidelines for their surveillance and trade activities.
15. That the FAO, World Bank and other multilateral and bilateral donors should continue to provide assistance to further strengthen countries' compliance with international standards, including on quality of Veterinary Services.
16. That the OIE develop guidelines for AI virus inactivation in processed products.
17. That strategies be developed for financing sustainable, concrete action at local level, to include support for restocking or compensation for losses, to encompass education on safe poultry keeping and the development of appropriate infrastructure and services.
18. That the OIE designate prescribed tests for international trade where pre-movement testing is required by the *Terrestrial Code*.
19. That OIE/FAO Reference Laboratories collaborate to exchange virus isolates and develop internationally agreed standards for diagnostic testing. The exchange of virus isolates and other information such as sequence data between the OIE/FAO laboratory network and the WHO laboratory network is urged.

(Adopted by the OIE/FAO International Scientific Conference on Avian Influenza,

7–8 April 2005)

General Recommendations for the 73 General Session:

The OIE referred the scientific information generated and discussed at this international conference, as well as this Recommendation to the OIE Regional and relevant Specialist Commissions and request the endorsement by the OIE International Committee during the 73 General Session in May 2005.

APPENDIX 9 - KEY PARTNERS IN THE IMPLEMENTATION OF THE PROGRAMME

Food and Agriculture Organization (www.fao.org) of the United Nations was founded in 1945 with a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the condition of rural populations. FAO has strong multidisciplinary programs and a comprehensive knowledge base with respect to animal diseases and related disciplines (including food safety; agricultural and pro-poor livestock policy development; livestock, environment and development; commodity multisectoral investment programs; and management of medium-term plans). Under the aegis of EMPRES, the Global Rinderpest Eradication Program of FAO has achieved the eradication of Rinderpest in the whole of Asia. In response to repeated shocks of infectious livestock diseases, FAO has recently established an Emergency Centre for Transboundary Animal Diseases (ECTAD) within EMPRES to specifically support control of such diseases globally. Through its joint FAO-IAEA Division in Vienna, FAO has its own laboratories recognized by both WHO and OIE as a Collaborating Centre, and through the FAO-IAEA Coordinated Research Program FAO supports animal disease control in more than 70 countries, including those in the GMS. FAO has taken the global lead in the establishment of transboundary animal disease information systems. Furthermore, the Food Quality and Standards Service in FAO hosts the Secretariat of the Codex Alimentarius Commission, which sets international food standards, guidelines and recommendations. Thus FAO has strong expertise in other technical areas which are very relevant to this project – e.g. strengthening capacity in disease control, early warning and early reaction systems for TADs. FAO’s Regional Office for Asia also hosts the APHCA, a regional commission. APHCA has an Executive Committee, which is represented by directors or commissioners of departments of livestock development of each member country. Member of APHCA have in their recent meeting (August 2003) identified the activities outlined in this programme as their priority.

World Organization for Animal Health (OIE) (www.oie.int/eng/en_index.htm) is the world health organization for animal health. It is an intergovernmental organization with 167 Member Countries, each represented by the country’s senior veterinary health official. OIE has four main objectives – to guarantee the transparency of animal disease status world-wide; to collect, analyse and disseminate veterinary scientific information; to provide expertise and promote international solidarity for the control of animal diseases; to guarantee the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products. OIE also plays a leading role in food safety of animal origin by collaborating with Codex Alimentarius Committee. OIE standards are recognized by the WTO as reference international sanitary rules. OIE has a Regional Representation for Asia and Africa. OIE has a network of reference laboratories and collaborating centres to provide scientific and technical assistance and expert advice on topics linked to disease surveillance and control. The laboratories provide various forms of support which include: making experts available, preparation and supply of diagnostic kits or reference reagents, practical work, training courses, workshops and organization of scientific meetings.

FAO and OIE have signed (May 2004) an agreement to develop an initiative called GF-TADs (see Appendix 4) which will serve as a global umbrella for the development of AI global strategy. They have also launched (April 2005) a Network of Expertise on avian influenza (OFFLU) to conduct research on AI flu, provide expertise to the countries and Regional Organisations and improve the collaboration, particularly in the exchange of HPAI virus strains between veterinary and human health research laboratories.

WHO: The World Health Organization (www.aseansec.org) is the United Nation’s specialized agency for health with a mission to attain the highest level of health for all peoples, particularly the poor and most vulnerable. A key focus of WHO is food safety. WHO, in collaboration with FAO, administers the Codex Alimentarius, the international food code by which food quality is measured. The WHO has also established global influenza programme, the oldest disease control programme at WHO with a major task to provide global influenza surveillance. The programme has a network of laboratories commissioned to study circulating influenza viruses, collected from around the world, and document changes in the viruses’ genetic make-up. Today, the WHO Global Influenza Surveillance Network consists of 113 national influenza centres located in 84 countries, and four WHO collaborating centres for influenza reference and research, located in London (England), Atlanta (USA), Melbourne (Australia), and Tokyo (Japan). A fifth collaborating centre, located in Memphis, USA, performs specialized work on influenza viruses in animals. The WHO network has thus contributed greatly to the understanding of influenza epidemiology and assists manufacturers both by ensuring that influenza vaccines contain the most appropriate viruses and by providing them with high-yielding “seed” virus for vaccine production. WHO is also an important partner in the GF-TADs initiative and will share and pool resources to develop common disease information system with FAO and OIE to keep the international community constantly alert to the threat of outbreaks of infectious diseases.

AU-IBAR: African Union Interafrican Bureau for Animal Resources (IBAR) was founded in 1951 by the Commission for Technical Cooperation in Africa, the office was first known as the Interafrican Bureau for Epizootic Diseases (IBED). In 1956 its functions were expanded to include other animal diseases and it was renamed the Interafrican Bureau for Animal Health (IBAH). The African Heads of State and Government, having seen the need to retain the services and functions of IBAH at the establishment of the OAU in 1963, in their first Assembly held in Cairo in July 1964 established the Scientific and Technical Research Commission (STRC) which took over the CCTA in June 1965, with IBAH as one of its offices. In 1970 the mandate of IBAH was broadened to include animal production and it was redesignated the Interafrican Bureau for Animal Resources (IBAR). IBAR's mandate, which guides its functions emanates from the OAU's highest authority, which comprise the Heads of State and Government. IBAR is the only organ in Africa that can rapidly respond to the problems of animal resources at continental level because of its mandate. The overall objective of IBAR is the improvement of animal resources of Africa. Inherent in this is the desire to improve the nutrition of the people of Africa by ensuring availability of adequate livestock products, and at national level to improve livestock agricultural economy and at individual level to increase the income especially of the small scale livestock owners.

Tree offices will identify for the coordination of the TCP activities: Nairobi (Kenya), Bamako (Mali) and Cairo (Egypt). Others facilities will be provided by the PACE (Pan African Programme for the Control of Epizootic diseases). Ministries of agriculture/departments for livestock development and/or animal health of each participating countries will be involved an active members of the strategy. They will have an important role in executing a number of country specific activities, epidemiological surveys, and contributing to the management and long term sustainability of disease surveillance, emergency preparedness and strong links with the regional coordination mechanism. <http://www.africa-union.org/Rural%20Agriculture/AACAA/Statement>

Arab Maghreb Union (AMU): (<http://www.imf.org/external/np/sec/decco/amu.htm>)

The Arab Maghreb Union (AMU) encompasses five North African countries that have strong historical, cultural, and language affinities. The first Conference of Maghreb Economic Ministers, which took place in Tunis in 1964, established the Conseil Permanent Consultatif du Maghreb (CPCM) between Algeria, Libya, Morocco, and Tunisia, to coordinate and harmonize the development plans of the four countries as well as inter-regional trade and relations with the EU. However, for a number of reasons, the plans never came to fruition. It was not until the late 1980s that new impetus began to bring the parties together again. The first Maghreb Summit of the five Heads of State, held at Zeralda (Algeria) in June 1988, resulted in a decision to set up the Maghreb High Commission and various specialized commissions. Finally, on February 17, 1989 in Marrakech, the Treaty establishing the AMU was signed by the Heads of State of the five countries. As of May 1997, there have been a total of 37 Maghreb conventions.

The main objectives of the AMU Treaty are to strengthen all forms of ties among Member States (in order to ensure regional stability and enhance policy coordination), as well as to introduce gradually free circulation of goods, services, and factors of production among them. Common defense and non-interference in the domestic affairs of the partners are also key aspects of the Treaty. The Treaty highlights the broad economic strategy to be followed, namely, the development of agriculture, industry, commerce, food security, and the setting up of joint projects and general economic cooperation programs. The agreement does not view bilateral arrangements between the parties as an obstacle to the development of multilateral relations. Finally, the agreement provides the possibility for other Arab and African countries to join the Union at a later stage.

A *Consultative Assembly*, consisting of 30 representatives from each Member State that can advise the Council of Heads of State, and a *Court of Justice*, composed of two judges from each Member State, have been set up in Algiers and Nouakchott respectively. In 1992, the AMU's *Secretariat General*, was established permanently in Rabat. It has an annual operational budget of US\$1.7 million, attained through equal contributions from each member. A number of specialized committees have been working in such areas as food security, economic and financial affairs, basic infrastructure, and human resources.

Southern African Development Community (SADC): ()

The Southern African Development Co-ordination Conference, SADCC, the forerunner of the SADC, the Community, was established in April 1980 by Governments of the nine Southern African countries of Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

The formation of SADC was the culmination of a long process of consultations by the leaders of Southern Africa. Towards the end of the 1970's, it became clear to the leaders of the region that just having a national flag and a national anthem would not meet the needs of the people for improved living standards. The objectives of SADC are to: i) Achieve development and economic growth, alleviate poverty, enhance the standard and quality of life of the people of Southern Africa and support the socially disadvantaged through regional integration;

ii) Evolve common political values, systems and institutions; iii) Promote and defend peace and security; iv) Promote self-sustaining development on the basis of collective self-reliance, and the interdependence of Member States; v) Achieve complementarity between national and regional strategies and programmes; vi) Promote and maximize productive employment and utilization of resources of the Region; vii) Achieve sustainable utilization of natural resources and effective protection of the environment; viii) Strengthen and consolidate the long standing historical, social and cultural affinities and links among the people of the Region. Being South Africa the only world country free from Avian Influenza, it will be invite as observer and lead country.

Asian Countries: Ministries of agriculture/departments for livestock development and/or animal health of each participating countries will be involved an active members of the strategy. They will have an important role in executing a number of country specific activities, particularly at the level of farmer and extension level training programs, epidemiological surveys, and contributing to the management and long term sustainability of disease surveillance, emergency preparedness and strong links with the regional coordination mechanism. They will also have an important responsibility to share and disseminate information in order to achieve control of HPAI at a regional level. Participating countries with more advanced economies have also pledged to support other countries in the region for them to be able to fully participate in the collective efforts to control HPAI regionally. All the countries in the sub-region have identified HPAI as a major priority and have committed to cooperate to tackle the HPAI problem. Majority of the countries are also members of the FAO's Animal Production and Health Commission of Asia and the Pacific Region with a common vision to control TADs.

The Association for Southeast Asian Nations (ASEAN): (www.aseansec.org) ASEAN, established in 1967 has Brunei Darussalam, Cambodia, Lao PDR, Myanmar, Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam as its members. The ASEAN region has a population of about 500 million, a total area of 4.5 million square kilometers, a combined gross domestic product of US\$737 billion, and a total trade of US\$ 720 billion. Its aims are: (i) to accelerate the economic growth, social progress and cultural development in the region through joint endeavours in the spirit of equality and partnership in order to strengthen the foundation for a prosperous and peaceful community of Southeast Asian nations, and (ii) to promote regional peace and stability through abiding respect for justice and the rule of law in the relationship among countries in the region and adherence to the principles of the United Nations Charter. One of the major objectives of ASEAN is to promote economic cooperation within the region. Today, ASEAN economic cooperation covers the following areas: trade, investment, industry, services, finance, agriculture, forestry, energy, transportation and communication, intellectual property, small and medium enterprises, and tourism. ASEAN has a Sectoral Working Group on Livestock that advises on issues related to livestock development and trade. Currently, ASEAN has specifically created an Animal Health Trust Fund to tackle regionally the problem of transboundary animal diseases on a long-term sustainable way. Currently under this trust fund ASEAN conducts the South East Asia FMD control programme.

South Asian Association for Regional Cooperation (SAARC) (www.saarc.org), The SAARC comprises Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The organization was established by member countries in 1985 and is located in Katmandu, Nepal and is driven by the Integrated Programme of Action, which includes five agreed areas of cooperation (Agriculture, Rural Development; Telecommunication, Meteorology; and Health and Population). The main objectives of these are to a) promote the welfare of the peoples of South Asia and to improve their quality of life; b) to accelerate economic growth, social progress and cultural development in the region and to provide all individuals the opportunity to live in dignity and to realize their full potential; c) to promote and strengthen collective self-reliance among the countries of South Asia; d) to contribute to mutual trust, understanding and appreciation of on another's problems; e) to promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields; f) to strengthen cooperation with other developing countries; g) to strengthen cooperation among themselves in international forums on matters of common interests; and h) to cooperate with international and regional organizations with similar aims and purposes. These objectives are compatible and in harmony with the member countries and the two international partners identified for the programme. SAARC has seven Technical Committees: 1) Agriculture and Rural Development (including Livestock and Fisheries) – India, 2) Health and Population Activities (including nutrition and drug related issues) – Nepal, 3) Women, Youth and Children – Bangladesh, 4) Environment and Forestry – Bhutan, 5) Science and Technology, and Meteorology – Pakistan, 6) Human Resources Development (including Education, Skill Development, Arts, Culture & Sports) – Sri Lanka, 7) Transport (including Land, Water, Railway and Civil Aviation) – India. SAARC has already a strong experience in the establishment and conduct of regional centres. Currently under its umbrella there are five Regional Centres with the principal objective of promoting regional cooperation in several areas that in-

clude a) SAARC Agricultural Information Centre (SAIC), Dhaka b) SAARC Tuberculosis Centre (STC), Katmandu c) SAARC Documentation Centre (SDC), New Delhi, d) SAARC Meteorological Centre (SMRC), Dhaka, e) SAARC Human Resource Centre (SHRDC), Islamabad, f) SAARC Cultural Centre (Sri Lanka), g) SAARC Coastal Zone Management Centre (Maldives), h) SAARC Information Centre (Nepal). SAARC has a significant involvement in poverty alleviation in the region through several programmes. SAARC has also close linkages with several international and regional organization which include: European Commission, UNCTAD, UNICEF, ESCAP, UNDP, UNDCP, further strengthened with additional agreements in pipeline with ASEAN, FAO, UNEP, UNFPA CIDA, WHO, UNIFEM, ADB; WB, UNAIDS, These linkages are being and UNIDO.

Economic Cooperation Organization (ECO) is a regional organization comprising the following member states: Islamic State of Afghanistan, Republic of Azerbaijan, Islamic Republic of Iran, Republic of Kazakhstan, Kyrgyz Republic, Islamic Republic of Pakistan, Republic of Tajikistan, Republic of Turkey, Turkmenistan and Republic of Uzbekistan. ECO is covering 7.9 million km²; with more than 350 million population, set to promote sustainable economic development of the region. The agriculture sector plays a vital role in ECO countries. Abundance of agricultural resources in the ECO region offers a great potential for mutually-beneficial cooperation in this sector. (<http://www.ecosecretariat.org/Directorates/dem.htm>)

The Arab Organization for Agricultural Development (AOAD) was established in 1970, upon the desire of the Arab countries. Realizing the vital role of agriculture within the region's economy, the Arab countries recognized the need for coordination between their different policies in agriculture, natural and human resources as well as economic development, in order to achieve the ultimate goal of fully integrated Arab economies .AOAD started operating in 1972. Due to the abundance of Sudan's natural resources, in particular in agriculture, Khartoum was selected to host the organization's headquarters .

AOAD is one of the specialized Arab organizations, functioning under the umbrella of the League of Arab States. As such, its members are all the member states of the Arab League. The organization's goals, stated upon its establishment, are defined on two dimensions: nationally as well as regionally. At the national level, AOAD is to assist member countries in developing and enhancing their respective agricultural sectors. At the regional level, AOAD is to facilitate coordination amongst member states in the agricultural sector, with the aim of achieving a fully integrated Arab economy union, and food self-sufficiency .
(http://www.aoad.org/about_en.htm)

GCC

Arabia, the area made up of the Arabian Peninsula, is located in the southwestern region of the Asian continent. Covering about 3 million square kilometers, the southeastern area of the peninsula is the Rub'al-Khali, the Empty Quarter, which is the world's largest expanse of continuous sand. Politically, the Arabian Peninsula consists of Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, the Sultanate of Oman, and the Republic of Yemen. Together, these countries (excluding the Republic of Yemen) constitute the **Gulf Cooperation Council (GCC)**. Founded on 26 May 1981, the aim of this collective is to promote coordination between member states in all fields in order to achieve unity.
http://www.sheikhmohammed.co.ae/english/history/history_arabia.asp

CIRAD: (Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement), is a French agricultural research centre working for development in developing countries and the French overseas regions. Most of its research is conducted in partnership. In the context of major global issues such as alleviating poverty and ensuring food security, sustainable development and streamlined management of natural resources and environment protection, CIRAD conducts training, information and innovation programmes, research, experiments and appraisals. It applies its skills in the life sciences, social sciences and engineering sciences to agriculture and agrifoods, to natural resource management and to human societies. It has a staff of 1850, including 950 executives, and an operating budget of 170 million euros.
http://www.cirad.fr/en/le_cirad/pdf/cirad04.pdf

Organization of the Petroleum Exporting Countries (OPEC) (www.opec.org)
OPEC is an international Organization of 11 oil-exporting developing nations that co-ordinates and unifies the petroleum policies of its Member Countries. OPEC seeks to ensure the stabilization of oil prices in international oil markets with a view to eliminating harmful and unnecessary fluctuations, due regard being given at all times to the interests of oil-producing nations and to the necessity of securing a steady income for them; an efficient, economic and regular supply of petroleum to consuming nations; and a fair return on their capital to those investing in the petroleum industry.

The Saudi NCWCD (National Commission for Wildlife Conservation and Development) has been working with the EU (European Union) to establish protected wildlife sanctuaries in the Persian Gulf not just for the green turtle but for many species of birds as well. The Saudis have declared several uninhabited islands as sanctuaries including Ganah, Karan, Jurayt, Kurayn and Harqus. Other conservation efforts include tagging turtles to monitor their life cycles and behaviors. They are also working with the other Gulf states (including Qatar) through the GCC (Gulf Cooperation Council) to set up a database to coordinate conservation information and activities. (<http://www.american.edu/TED/green.htm>)

Wetlands International works globally, regionally and nationally to achieve the conservation and wise use of wetlands, as a contribution to sustainable development. **Mission:** To sustain and restore wetlands, their resources and biodiversity for future generations. The International Waterbird Census (IWC) launched in 1967 by the International Waterfowl and Wetlands Research Bureau (IWRB - one of the three organisations, which formed the new Wetlands International organisation in 1995), is the longest running, most extensive and harmonised (waterbird) monitoring programme in the world. Its development, at that time regionally restricted and not global, was part of growing concern about the ongoing loss of wetlands and waterbird populations.

Donors: It is expected that this multidisciplinary regional programme with broad outputs related to the Millennium Development Goals will interest a number of both bilateral and multilateral donors active in the region. Key among these will be ADB, WB, EU, JICA, and governments specifically interested in reducing the global threat of diseases to humans and livestock, and reducing global poverty.

APPENDIX 10 - HPAI AND MIGRATORY BIRDS

Potential risk of Highly Pathogenic Avian Influenza (HPAI) spreading through wild water bird migration

There is a potential risk that HPAI subtype H5N1 might be carried along migration routes of wild water birds to densely populated areas in the south Asian subcontinent and along migratory flyways to Africa and Europe. Recent outbreaks of HPAI in Russia and Kazakhstan (August, 2005) may be suggestive of the role of wild birds in the epidemiology of HPAI. The complex overlapping of major flyways (Fig 1) and the lack of information on migratory species potentially involved in AI disease spread make simple association of wild bird flyways with outbreaks of AI difficult. However, it is plausible that HPAI H5N1 virus could spread from Siberia to the Caspian and Black Sea areas in the foreseeable future. Some birds are currently nesting in the newly HPAI affected areas of Novosibirsk and Altai in Russia and will migrate to the above-mentioned areas for upcoming winter or land to rest areas on their way to Africa and Europe. The exact risk will likely depend on the identification of specific migratory species that carry H5 viruses without suffering the disease, and knowledge of their resting areas and wintering grounds combined with the existing production poultry systems and husbandry. Bird migration routes run across southwest Asia and some Mediterranean countries, where bird flu outbreaks could possibly occur. India and Bangladesh, which currently have no indication of disease, are at risk. Bangladesh in particular, and to a lesser extent India, harbour large numbers of domestic ducks and the countries are situated along one of the major migratory routes or are known important bird wintering areas. The countries have the potential to become new large endemic foci of H5N1 infection. Additionally, the spring migration of 2006 may result in the spread of HPAI H5N1 virus further across Europe since birds migrating from southern zones will have intermingled with European Russia and Siberia-origin birds during the 2005/2006 winter nesting areas.

Background

Highly Pathogenic Avian Influenza (HPAI), subtype H5N1 has been occurring in poultry in Southeast Asia since 2003. Until recently, the outbreaks were restricted to Indonesia, Viet Nam, Thailand, Lao PDR, Cambodia and China. But since late July 2005, HPAI H5N1 has expanded in a north-westerly direction and both Russia and Kazakhstan have reported outbreaks in poultry as well as in wild birds. The Russian outbreak of HPAI H5N1 has to date, affected six administrative regions, and in the bordering area to Kazakhstan, the disease affected several villages. Mongolia reported the death of some 90 migratory birds at two lakes in the northern part of the country in early August, 2005. Influenza A virus subtype H5 was isolated from samples taken from dead wild water birds. From April to June, 2005 more than 6000 migratory birds have been reported to have died due to H5N1 infection at the Qinghai Lake Nature Reserve in Qinghai Province, China. This included bar-headed geese *Anser indicus*, great black-headed gulls *Larus ichthyaetus*, brown-headed gulls *Larus brunnicephalus*, ruddy shelducks *Tadorna ferruginea* and great cormorants *Phalacrocorax carbo*. In China (Tibet), the death of 133 breeding hens was reported and H5N1 was isolated from samples from these birds.

These new outbreaks suggest that this highly pathogenic H5N1 virus is spreading progressively north-westwards and not restricted to the Southeast Asian focus, where the outbreaks of AI started in mid-2003. In Russia and Kazakhstan, contact between domestic poultry and wild waterfowl at open water reservoirs is considered the primary source of infection for poultry.

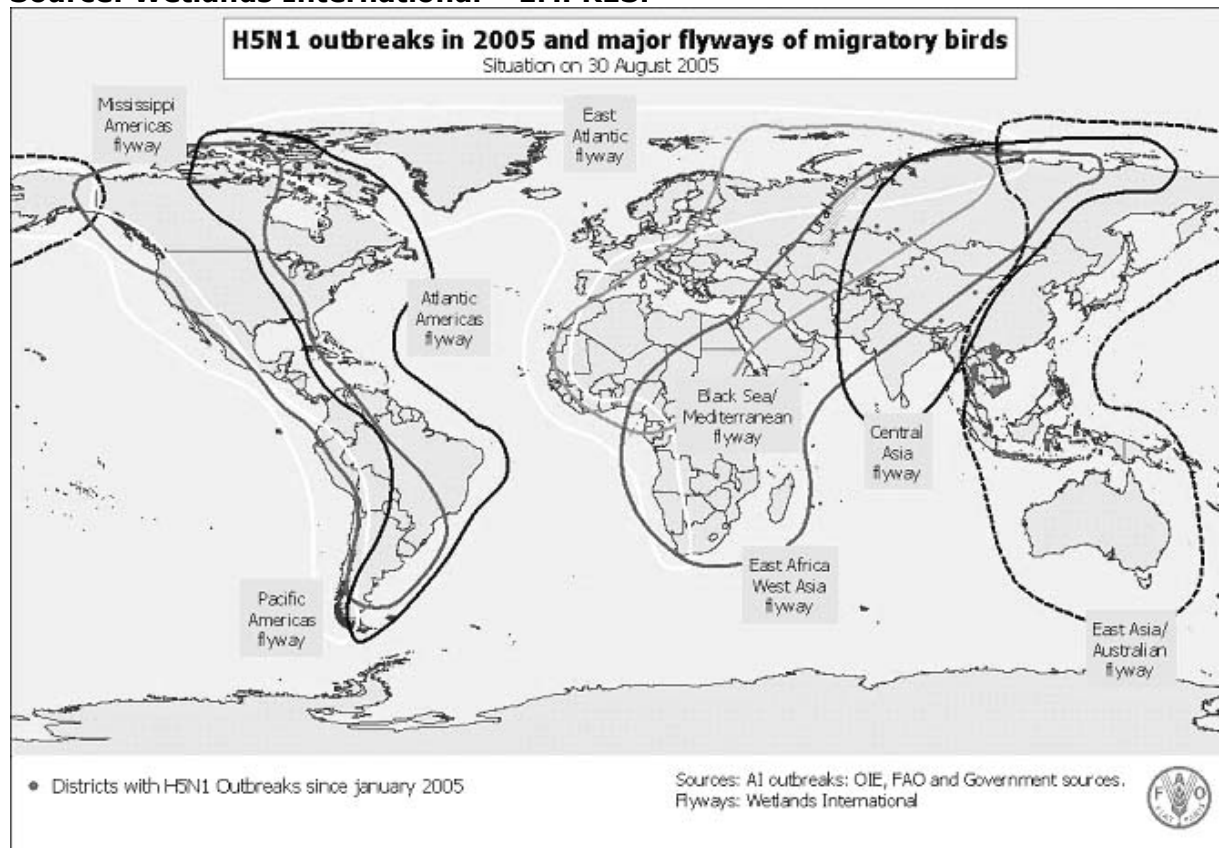
Role of wild birds

AI in wild birds

It has long been known that wild birds represent a reservoir for avian influenza viruses worldwide. This is a concern because many of these birds are migratory and travel over long distances across international borders. Wild birds have been shown to introduce novel influenza gene segments into a population, that when re-assorted with existing viruses can generate a dissimilar virus with different antigenic and other biological characteristics. The influenza viruses are easily spread by fomites and survive and spread well in water. Furthermore, certain species of ducks are able to carry influenza viruses without exhibiting any clinical signs of disease. Juvenile ducks have the highest rates of infection and shedding. High titres of virus occur in late-summer, when birds leave their northern breeding areas, although these titres decrease as birds continue southwards.

Figure 1. HPAI Outbreak 2005 and the major flyway of migratory birds

Source: Wetlands International – EMPRES.



Outbreaks of HPAI originating from low pathogenic viruses carried from wild birds, have occurred relatively frequently in domestic poultry in the last decade. But since about 40 years, there have been no large spontaneous outbreaks of HPAI in wild birds. However, recent surveillance studies in Europe showed that several influenza A viruses of subtypes H5 and H7 could be isolated from dead wild birds. These contained virus isolates that are closely related to isolates recovered from each of the recorded H5 and H7 HPAI outbreaks in Europe since 1997. To date, extensive testing of clinically normal migratory birds in the infected countries has not produced any positive results for H5N1 so far. All of the H5N1 viruses isolated from wild birds during the 2003-2004 outbreaks were from dead or dying birds which were located in the vicinity of infected poultry flocks or recently contaminated premises. It appears that the currently circulating strain of H5N1 is also highly virulent for certain wild birds including some species of ducks, as can be shown from the isolation of the virus from numerous dead wild birds and disease outbreaks in bird parks and zoos. In 2004 H5N1 was identified in several species of dead and dying birds including various wild birds in Thailand, magpies in Korea, crows in Japan, a zoo collection in Cambodia and a single heron and peregrine falcon in Hong Kong (Table 1). Similar to the outbreaks in Hong Kong in 2002, all of these birds were moribund or dead and would not have been able to carry the virus over long distances. In the spring 2005, an outbreak was detected in bar-headed geese at Qinghai Lake in central China, which is a protected nature reserve with no poultry farms in the vicinity.

Table 1. Reported cases of HPAI in wild birds in 2004/2005 (sources: OIE, country reports, GPHIN, ProMED)

COUNTRY	SPECIES	TYPE AI	DATE
China (Hong Kong SAR)	black-headed gull, Little Egret, Greater Flamingo, Grey Heron, various waterfowl, Pigeon and Tree Sparrow	H5N1	late Dec 2002 to Jan 2003
China (Hong Kong SAR)	Peregrine Falcon	H5N1	Mar 2003
China (Hong Kong SAR)	Peregrine Falcon	H5N1	Jan 2004
China (Hong Kong SAR)	Grey Heron	H5N1	Nov 2004
Cambodia	Wild birds in a zoo collection, including grey-headed fish eagle, serpent eagles, hawk eagles, spotted wood owls, brown fish owl, spot-bellied eagle owl, and buffy fish owls and psittacines	H5N1	Feb 2004
Japan	Crows	H5N1	Mar 2004
Korea	Magpies	H5N1	Mar 2004
Thailand	Pigeons, Open-Bill Storks, Little Cormorant, Red-collar Dove, Scaly Breasted Munia, Black Drongo	H5N1	Dec 2004
China (Hong Kong SAR)	Grey Heron	H5N1	Dec 2004
China (Hong Kong SAR)	Chinese Pond Heron	H5N1	Jan 2005
China	Bar-headed geese, Great black-headed gulls, Brown-headed gulls. Ruddy shelducks and Great cormorants	H5N1	Apr 2005
Mongolia	Bar-headed geese and Whooper swan	Influenza A subtype H5	Aug 2005
Russia (Siberia)	Wild birds	H5N1	Aug 2005
Kazakhstan	Wild birds	H5N1	Aug 2005

Migratory routes

Anatidae (ducks, geese and swans) is the family classification of water birds that are ecologically dependent on wetlands for at least part of their annual cycle. Anatidae species use a wide range of wetlands, from the high arctic tundra, rivers and estuaries, freshwater or saline lakes, and ponds or swamps to coastal lagoons and inter-tidal coastal areas such as mud-flats, bays and the open sea. They also utilise man-made wetlands such as rice fields and other agricultural areas.

Many of the Anatidae populations migrate between wetlands in the northern breeding areas and southern non-breeding areas and in doing so, regularly cross the borders of two or more countries. Southward migration for the northern-breeding Anatidae starts in July and increases throughout the following months. Most birds would have reached their winter range sometime between November and December. The migration takes them north to reproduction areas at the end of winter, beginning of spring. The winter of 2003-2004 when most of the outbreaks in South East Asia occurred, was when migratory bird densities in South East Asia were at their peak. This appears to implicate wild birds as a possible source for the infection. However, the pattern of the HPAI outbreaks does not coincide with migratory pathway of wild birds for all countries. It is important to note that, if introduced by migratory birds alone, outbreaks of avian influenza would also be expected to have occurred for example-in Taiwan Province of China (POC) and the Philippines, or even at the extreme range of the flyway in parts of eastern Australia and New Zealand, if shore birds are shown to be reservoirs. (Shore birds belong to the classification order Charadiformes and are not Anatidae). Many duck species identified to carry avian influenza viruses, winter in large numbers in Taiwan POC and the Philippines as well as in areas in Southern Asia. Migrating birds also tend to bypass mainland China, where numerous HPAI outbreaks have occurred, in favour of travelling down the coastline or across western China to avoid the Himalayan Mountains. Furthermore, the timing of the Indonesian and Malaysian outbreaks occurred outside the times when migratory birds would have been present in the countries. Therefore, unexplained factors other than shedding of AI viruses by migratory wild birds could possibly be at play in the dissemination of AI viruses.

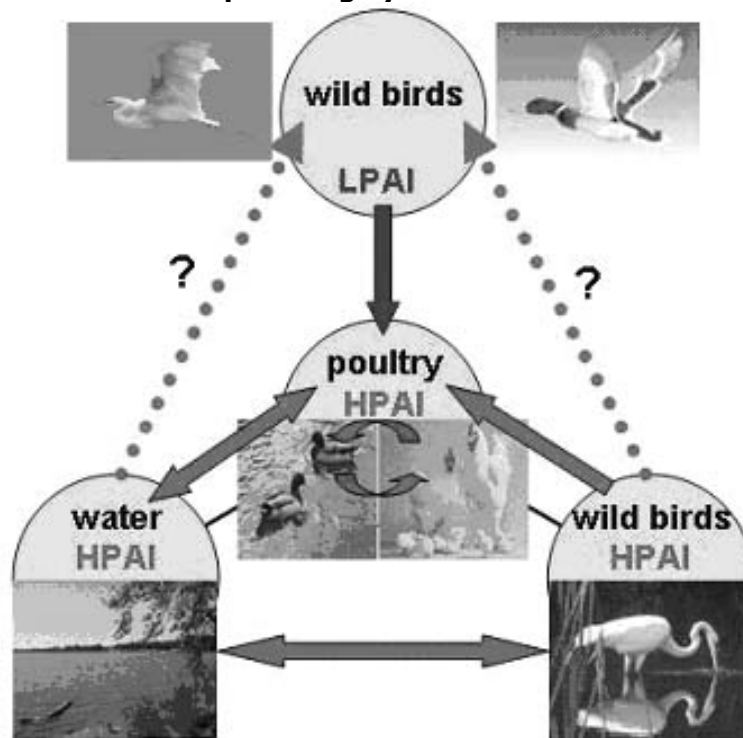
Conclusions

Looking at the epidemiological data currently available, evidence is mounting that wild water fowl may play an important role in the avian influenza cycle and could be the initial source for some HPAI viruses, which may be passed on through contact with resident water fowl or domestic poultry, particularly domestic ducks. In the event of Low Pathogenic viruses, the virus can undergo mutations or re-assort with viruses in the domestic and possibly resident bird populations until a HPAI virus arises. This new virus is pathogenic to poultry and possibly to the wild birds that it arose from (Fig. 2). Wild birds found to have been infected with HPAI were either sick or dead. This could possibly affect the ability of these birds to carry HPAI for long distances. However, the findings in Qinghai Lake-China, suggest that H5N1 viruses could possibly be transmitted between migratory birds. Additionally, the new outbreaks of HPAI in poultry and wild birds in Russia, Kazakhstan, Western China and Mongolia may indicate that some migratory species probably act as carriers for the transport of HPAI over longer distances. Short distance transmission between farms, villages or contaminated local water bodies is likewise a distinct possibility.

The AI virus has adapted to the environment in ways such as i) the use of water for survival and to spread ii) has evolved in a reservoir (ducks) strictly tied to water. The water in turn influences movement, social behaviour and migration patterns of water bird species. It is therefore of great importance to know the ecological strategy of influenza virus as well, in order to fully understand this disease and to control outbreaks when they occur. There remains a body of data and analysis missing on the collection and detection of HPAI viruses in wild birds. Finding HPAI viruses in wild birds may be a

rare event, but if the contact with susceptible species occurs it can cause an outbreak at the local level or in distant areas.

Figure 2. Model of an HPAI spreading cycle



EMPRES actions and recommendations

To prevent further spreading of H5N1, surveillance in domestic poultry as well as in wild birds should be strengthened in countries at immediate risk, especially along migrating bird routes. Resources should be focused on the reduction of close contacts between humans, domestic poultry and wildlife through better management practices and improved biosecurity practices in poultry production enterprises, especially those that are small and 'open-air' where domestic poultry and waterfowl are allowed to mingle with wild birds.

Officials would also need to monitor 'wet' and wildlife markets, where wild and domesticated species are kept in close proximity, which are at risk of exposure to a wide range of pathogens. Limiting contact with wild birds should therefore be part of any avian influenza control strategy. To protect domestic poultry, vaccination should be considered as a tool for the prevention and control of HPAI in at risk situations.

The control of avian influenza infection in wild bird populations at this stage, is not feasible – from a logistical, environmental and biodiversity point of view. Indiscriminate culling of wild migratory bird populations would be ineffective in preventing further spread of avian influenza and their hunting would likely cause dispersion of the birds.

Monitoring, sampling and analysis of the viral subtypes of avian influenza found in wild birds need to be done in order to fully understand their role in the propagation and spread of highly pathogenic avian influenza viruses. Multidisciplinary research is required that brings in the competencies of veterinarians, wildlife specialists, ornithologists, virologists, molecular biologists and other resource avenues.

Besides the current regional and country specific AI projects being implemented by FAO, Mongolia has been assisted through a regional technical co-operation programme project in reviewing emergency preparedness and surveillance activities for HPAI since the outbreak in wild birds were reported.

A Global Strategy for the prevention and control of HPAI has been prepared by FAO and OIE under the umbrella of the Global Framework for the Control of Transboundary Diseases (GF TADs). This Global Strategy addresses country level activities as well as the indispensable regional and international coordination.

Within the epidemiological context of the current HPAI outbreaks, there is an urgent need to strengthen the joint FAO/OIE/WHO Global Early Warning System (GLEWS) so as to improve the regional capacity for early detection and response to AI incursions. Immediate support to the Animal Health Services for emergency preparedness, surveillance and early response activities will be required in the Middle East, Africa, South Asia/South West Asia and parts of Eastern Europe.

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