Avian Influenza, Agricultural Trade and WTO Rules:

The Economics of Transboundary Disease Control in Developing Countries

Dr Buddhima Lokuge*, Dr Kamalini Lokuge**, Dr Tom Faunce^

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Abstract:

Avian influenza presents a number of unique challenges for the health and agricultural trade sectors of both developing and developed countries. The recent epidemic affecting more than eight Asian nations is unprecedented in its scale, geographic spread, and economic impact. We argue that the emergence of avian influenza strains with the capacity to spread internationally, infect humans and disrupt economies, redefines control efforts as a global public good necessitating concerted international intervention and cooperation. While international support for emergency response measures is important, sustained improvements and investments in national disease control systems require that countries view such activities as investments rather than internationally imposed costs. This requires a reorientation of how WTO sanitary and phytosanitary rules are viewed and implemented. To ensure that they are not used as protectionist barriers to agricultural exports from developing countries and that meaningful progress is made in relation to technical assistance provisions contained in the SPS agreement. The risk to global economic security and human health posed by AI and similar transboundary diseases creates an international imperative to address the economic and political barriers that limit incentives to invest in agricultural disease control systems in developing countries.

Key words: Avian influenza, international food trade, transboundary disease control, World Trade Organisation, SPS Agreement, influenza pandemic, global public goods.

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*Dr B.Lokuge, Project Director, International Trade, Innovation and Population Health, Centre for Governance of Knowledge and Development, Australian National University. **Dr K. Lokuge, Former Consultant, Avian Influenza, World Health Organisation, ^Dr T. Faunce, Lecturer Law Faculty, Senior Lecturer Medical School of the Australian National University. This paper was prepared for the project, *International Food Safety Regulation and Processed Food Exports from Developing Countries: A Comparative Study of India and Thailand* funded by Australian Centre for International Agricultural Research (ACIAR). The authors would like to thank Dr Prema-Chandra Athukorala for his advice and support.

1. Introduction

The recent avian influenza (AI) epidemic marks a new and unprecedented stage in the evolution of AI and the spread of diseases transmissible from animals to humans (zoonotic infections). Since December 2003, poultry in eight Asian nations (Cambodia, China, Indonesia, Japan, Lao People's Democratic Republic, Republic of Korea, Thailand, and Viet Nam) have been affected, and in most cases, several parts of each country have been affected simultaneously. For many of these nations, it was the first time they were dealing with an outbreak of this form of the disease, let alone one of such magnitude. As of February 2005, 100 million birds had died or been culled, while the human toll has reached 55 infections with 42 deaths (WHO 2005,WHO 2004b). Clearly, the nature of the disease and its international implications has changed remarkably.

This paper explores the regional and international implications of these developments. The rapid international spread of the disease demonstrated that many affected regions lacked the necessary agricultural disease surveillance and control infrastructure. We argue that the emerging human health and economic security concerns related to the international spread of the disease and the potential link to human influenza pandemics, redefines agricultural disease control investments as global public goods necessitating concerted international intervention and cooperation. While international support for emergency response measures is important, sustained improvements and investments in disease control requires that developing countries view such activities as investments rather than internationally imposed costs. We argue that an important driver of sustained investments by developing countries is their participation in the international trade in agricultural and processed food exports, and consider as evidence the effective response to AI from those developing countries in the region with established poultry export industries.

Despite their comparative advantage in terms of labour costs, we examine how a major barrier to the establishment of such export industries in these countries is the system of SPS[1] regulations that control trade in poultry and other agricultural and processed food exports. Although in theory this system is based on a concern for animal health and food safety, the differential compliance costs and its inconsistent application mean that they are often viewed by developing nations as unfair protectionist barriers to developed economy markets. This paper is an initial exploratory study, aimed at raising issues that we consider to be important to the debate surrounding the recent outbreak. We hope that once further data becomes available, this work will guide future studies examining in detail the issues we raise here.

2. Avian Influenza: Trade and socio-economic implications for Asia

There are an estimated 6 billion domestic birds in eastern and south-eastern parts of Asia, and just over half of these are held in medium to large, intensive production facilities, with the remainder are in smallholdings (FAO 2004). While small producers account for under half the volume of production throughout the region, numerically they represent the majority of poultry owners. For example, in Thailand smallholders own 30% of poultry stocks but represent 97% of holdings. In China traditional backyard production represents 56% of the countries poultry sector, and in Cambodia, 75% of poultry production is by subsistence farmers (FAO 2004b).

For developing countries, and particularly in low-income households, poultry can be an inexpensive source of protein and a means to generate income that is not capital intensive or high risk. At the national level, processed poultry products represent a labour intensive, value added export industry that can have a positive effect on unemployment and the balance of trade. The importance of the poultry industry in Asia in terms of food

[1] Sanitary and phytosanitary (SPS) measures, relate to standards for food safety and animal and plant health. The WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) outlines how Governments can protect animal, plant and human health without creating protectionist trade barriers.

security, employment, rural income generation and exports means the consequences of the present outbreak are far reaching. An estimated 100 million birds died or were culled as a result of the epidemic. As news of avian to human transmission of AI broke many regions in Asia saw a drop in the consumption of poultry. In some cases, such as India, consumption fell to 80% despite the region being declared free of AI (FAO 2004b). Given that in low-income settings poultry and eggs are an important source of inexpensive protein, this has the potential to affect nutrition levels and food security in these populations.

The impact on smaller family operated commercial enterprises, particularly where poultry is the sole source of income is of particular concern. In Cambodia for example, subsistence farmers generate US $15-20 income from poultry sales per year, this figure representing nearly 2 months of sustenance for an average household (APHCA 2004b). Therefore, when assessing the socioeconomic impact of the disease and effectiveness of control efforts (FAO 2004), the implications for these estimated 200 million smallholders regionally must be a central consideration. Importantly, it is not only small producers with infected birds, but all those in a region that are affected by market closures; restricted movement of birds which may limit the ability to sell disease free products; and in some cases such as Singapore, the banning of all small scale poultry farming (FAO 2004b).

While the cost of elimination of a production cycle does not represent a significant burden to large scale intensive producers, the fall in demand and price as a result of market closures, substitution of other meat products, the loss of market share to competitors from regions not affected by AI, and the loss of consumer confidence and reputation for food safety will nevertheless impact on profitability and long term sustainability of firms and the industries in affected regions. Again, when bans are imposed on countries as apposed to affected regions or zones, all producers face the economics costs.

In terms of exports, the current AI epidemic will have a significant impact on the poultry sector in China and Thailand with international bans on poultry exports from these countries. South East Asia accounts for approximately a quarter of world poultry trade with China and Thailand the major suppliers. Thailand is the 4th largest poultry exporter after the US, Brazil and the EU and an estimated 40 percent of its production of fresh/chilled poultry and processed products were exported (AHPCA 2004). Thailand accounts for nearly 7 percent of world trade, with an export value of approximately US$1 billion, and until the current AI outbreak, it was one of the few countries in the region to have addressed food safety requirements to allow export to the profitable destinations of the EU and Japan (APHCA 2004). Prior to the current outbreak, Thailand supplied nearly 25 percent of European imports from third countries and approximately half of all Thailand's poultry exports went to Japan (AHPCA 2004). It is expected that the introduction of bans on Thai poultry products by these regions will lead to Brazilian and other competitors capturing market share (AHPCA 2004).

There is little doubt that the economic impact of AI will be significant. Importantly however, the degree of impact is directly related to the rapidity and extent of the control measures taken. World Bank estimates of the economic impact of AI on Vietnam assess the degree of disruption as directly related to the speed and effectiveness of control efforts. The study concludes that if controls were rapid, the impact of AI would only be 0.3 percent of GDP. On the other hand, if control were delayed and multiple sectors including tourism were affected by the incident, the cost could be up to 1.8 percent of Vietnams GDP (World Bank 2004).

The importance of timely control has been demonstrated in previous outbreaks. Delayed and partial control of an outbreak in Mexico in 1992 lead to widespread disease. This complicated eradication efforts, and the outbreak that began in 1992 was only controlled in 1995 at a considerable cost (WHO 2004). Delays in the reporting and subsequent instigation of control procedures are widely believed to have contributed to the scale and spread of the current AI outbreak in Asia (FAO/OIE/WHO 2004).

3. Avian Influenza and Human Influenza Pandemics: International implications

Avian influenza is caused by type A strains of the Influenza virus, and is found primarily in poultry and wildbirds, though several other species have been found to be susceptible. It was first identified in Europe 100 years ago (WHO 2004). There are numerous subtypes of varying degrees of virulence that can infect birds and the subtypes of concern (H5 or H7 subtypes[2]) are designated by the World Organisation for Animal Health (OIE) as Notifiable Avian Influenza (NAI). NAI viruses can be further divided into highly pathogenic avian influenza (HPAI) and low pathogenic avian influenza (LPAI). Outbreaks of LPAI are common, for example, 100 outbreaks have occurred in the US in last 25yrs (Havorson et al 2003). HPAI, classified as a list A[3] disease by the OIE, has a mortality rate that can approach 100% in poultry, but was comparatively rare until recently. From 1959 to 2002, only 21 outbreaks of HPAI had occurred worldwide, and of these, only five spread to multiple farms, and only one spread to another country (WHO, 2004b).

Reasons for the recent change in the epidemiology of AI, highlighted by the current epidemic, are unclear. The increased concentration of birds in large scale, intensive, farming as well as greater numbers in backyard farms is likely to be an important factor (FAO 2004d). High intensity systems result in the production of genetically similar animals in close quarters, which predisposes to rapid spread and uniform mortality levels once a pathogen enters the stock. In addition, many of the production systems that supply feedstock and day old chicks (DOC) to these large producers, as well as those that

[2] For the purposes of this Terrestrial Code of the OIE, notifiable avian influenza (NAI) is defined as an infection of poultry caused by any influenza A virus of the H5 or H7 subtypes or by any AI virus with an intravenous pathogenicity index (IVPI) greater than 1.2 (or as an alternative at least 75% mortality) (OIE 2003).

[3] Highly pathogenic avian influenza is categorized by OIE as a "list A" disease. List A includes transmissible diseases "which have the potential for very serious and rapid spread, irrespective of national borders, which are of serious socio–economic or public health consequence and which are of major importance in the international trade of animals and animal products (WHO 2004c)

process and market poultry products within countries are centralised, allowing rapid transmission of disease from one area to another. In a recent paper examining a large scale outbreak of HPAI due to H7N1 strain of AI in Italy in 1999, the authors raised factors such as semi-vertical integrated systems of farming and overlapping production circuits as likely to have contributed to the extent of the outbreak (Capua et al. 2003).

In addition to the increasing propensity for AI viruses to cause large-scale outbreaks in poultry, an even more worrying trend has been the increasing number of outbreaks where there has been confirmed spread from animals to humans. This carries with it the spectre of large-scale human influenza pandemics. All influenza viruses, including those that cause AI and those that cause seasonal influenza epidemics in humans, are genetically unstable and as a result have a propensity to transform or mutate into virulent forms that can potentially cause epidemics. Additionally given the right environment different subtypes of human and animal influenza strains can swap or exchange genetic material (antigenic shift). This can result in new forms of influenza for which human populations have no immunity and is therefore highly lethal. If the new subtype has characteristics that readily allow human-to-human transmission, this combination can result in a form of human influenza with the ability to cause widespread outbreaks and large numbers of deaths worldwide, an occurrence termed a pandemic.

The capacity for AI strains to cross the species barrier from birds to humans has been demonstrated in several recent outbreaks (Capua and Alexander 2004) . The first recorded occurrence of such an event was in 1997 in Hong Kong, where an outbreak of the H5N1 strain of AI in poultry lead to 18 reported human infections and 6 deaths (WHO 2004). Studies at the genetic level confirmed that the human infections were caused by direct transmission of the virus from birds to humans. This event caused significant alarm in the international public health community, as it was the first time that AI had been shown to cross the species barrier to directly infect humans. Since then, cross species transmission to humans has subsequently occurred again in Hong Kong, then Korea, and in 2003 in the Netherlands, where several people were infected and one fatality was reported as a result of human infection with a H7N7 strain of AI.

Both the WHO and infectious disease experts postulate that the next human influenza pandemic is likely to develop through the reassortment of the viral genetic material in environments where high levels of human and avian influenza coexist (Trampuz *et al* 2004). Humans and pigs in particular, when infected with both human and avian strains of the virus, can act as genetic mixing vessels for the emergence of new forms of the AI capable of human to human spread.

History tells us that the human and economic costs of such an event would be devastating. The 20th century has seen three major influenza, pandemics with the great influenza pandemic of 1918–1919 (Spanish flu), causing an estimated 600 million infections and 40 to 50 million deaths worldwide (ADB 2004). A study by the US National Centre for Infectious Diseases in 1999 estimated that the economic impact of an influenza pandemic in the United States would range from US$71.3 billion to US$166.5 billion (Meltzer.M, Cox. N, and Fukuda. K, 1999).

Until the most recent outbreak in Asia, the human cases of AI due to direct transmission from animals occurred in developed countries. In these outbreaks, the immediate culling of the entire population of potentially infected poultry is thought to have prevented the spread of disease and therefore the opportunity for a new form of Influenza to emerge (Laver, 2001). Such a response has not been seen in many of the regions affected by the current outbreak. Outbreaks continue to be reported from affected regions (Reuters 2004), and the threat to human health continues as long as AI is present in the productions systems of these countries. The human influenza pandemic potential means that AI is now not simply an issue for affected countries or for their agricultural and trade systems to deal with in isolation. It is an externality that deserves global attention and a coordinated long-term international response.

As result the FAO, OIE, and WHO jointly published recommendations calling for extensive investments in veterinary infrastructure (human resources, equipment and laboratory supplies etc), disease surveillance, financing systems for compensation and rehabilitation of farms and regions affected by the disease (FAO/OIE/WHO,2004). These guidelines call for extensive restructuring of the industry. For example the OIE recommends the creation of biosecure productions zones quarantined from wildbirds, while human influenza pandemic concerns have lead the WHO to recommend the reorganization of poultry production systems so as to;

- Reduce human exposure to infected poultry
- Separate animals from routine human contact, and
- create systems that allow the rapid detection of AI outbreaks in poultry (WHO 2004e).

Clearly the investments needed to upgrade agricultural and disease control systems in developing countries will be extensive. Various forms of assistance have been delivered to the developing countries affected by the Asian AI outbreak. The FAO has funded Technical Cooperation Programmes (TCP) in affected and at-risk countries and sub-regional projects covering clusters of countries in parts of Asia,directed atsupport ingnational efforts to control/eradicate the disease and for the post influenza rehabilitation of industries (APHCA 2004b). Additionally substantial assistance for control has been delivered by the WHO, ADB, World Bank, EU and through bilateral agencies.

4. The WTO Sanitary and Phytosanitary Agreement: a barrier investments in agricultural disease control

While the above emergency measures are important, the investments necessary to achieve sustained improvements require a reorientation of how developing countries approach the financing of such activities, towards viewing these as cost effective investments in themselves, rather than internationally imposed costs. Protecting pre-existing export revenues and expanding new export markets, is one of the most powerful incentives for Governments and industry to upgrade agricultural and disease control systems and maintain them once donors leave. Exporters in the region such as Thailand had advanced animal and food safety systems that allowed rapid notification and control procedures to be instigated and the incentives for self-regulation and transparency (FAO 2004c. p45). However, agricultural and processed food export development in developing countries requires assistance to overcome the current economic, technical and political barriers inherent in WTO SPS standards.

Developing countries, which account for a considerable proportion of world poultry production capacity, are underrepresented in terms of international trade (Josling et al 2001). A significant proportion of world poultry exporters are concentrated in the US, EU, Brazil and Hong Kong. While factors such as processing facilities, transport and marketing are important to export development, a significant barrier to the expansion of agricultural and processed food exports in developing countries is the system of SPS standards (Josling et al 2001). Countries with significant production capacity like India (the worlds 5th largest producer of eggs and 18th largest broiler producer), have not been able to addressed these issues to significantly penetrate high value export markets in the US and Europe (Metha. R, George. J 2003).

Trade analysts note that while most SPS requirements are essential to protect animal, plant and human health in import nations, they can act as intentional or incidental impediments to exports, particularly those from developing countries (Athukorala et al 2003, Josling et al 2001, Otsuki et al 2000). SPS trade barriers include the differential interpretation of scientific knowledge, national regulations above international standards, and the differential application of standards to imports. Developing countries face additional hurdles including differential compliance costs, such as those arising from the need for international veterinary and medical certification (not readily available in many regions). Importantly from the perspective of investments in SPS and disease control, it is not simply the fact that standards are high compared to existing levels in developing countries that make them difficult and costly to meet, but that they are subject to frequent changes. This makes returns on investments in SPS uncertain, as meeting current international SPS standards does not necessarily translate into access to export markets in the future. The real or perceived 'sovereign risk' of investments in SPS and the unpredictability of upgrades leading to market access and export revenues is only likely to increase as traditional barriers such as tariffs and quotas decline following the Uruguay round of negotiations.

The effective engagement of the WTO system requires that countries make large initial investments to comply with the standards set by the SPS agreement and also additionally obtain the legal and scientific expertise to initiate and defend unjustifiable bans on their exports (Athukorala et al 2003). These outlays can be prohibitive. The investment needed to take advantage of the WTO SPS system has been estimated by the World Bank to amount to 'an entire year's development budget' for most of the developing and transitory economies' (Finger and Schuler, 2000, p. 511 quoted in Athokorala 2003).

When the SPS agreement was established it was clear that these concerns would isolate and diminish the benefits of participation for developing countries. In recognition of this, Article 9 of the Agreement encourages developed economy members of the WTO to provide technical assistance to developing countries, and Article 10 allows for special and differential treatment with 'time-limited exceptions in whole or in part from obligations under this Agreement, taking into account their financial, trade and development needs' (Article 10, SPS Agreement). Unfortunately developed countries have taken limited measures to accord with the responsibilities created under Article 9, and as a result, multilateral agencies have begun to fund capacity building programs to address this gap (Athukorala et al 2003). However, even these methods of international cooperation have suffered from weak financial and political support (FAO 2004c).

Developed economies that have been affected by AI outbreaks have been able to utilise the WTO system to rapidly re-establish exports. For example following the outbreak of HPAI in the Netherlands in February 2003, the authorities were able to reopen exports of live poultry and hatchling eggs by 18 June from all but the five affected zones (EU 2003). This was also the case with AI outbreaks in Texas, USA.

Avian Influenza: a new paradigm

The economic and human health implications of AI require that the exploitation of SPS regulations for domestic political reasons must take second place to the international need for cooperation and sustained investments and improvements in agricultural systems. It has increased the cost of failure to upgrade agricultural systems in resource poor settings, and the cost of failing to meet the responsibility that developed countries have to developing nations under article 9 and 10 of the WTO, SPS agreement. The perception that SPS regulations are sometimes unevenly and unjustifiably applied needs to change to provide producers and governments in developing countries with the incentive to make the considerable investments that are needed.

It is also important that current exporters from the region facing international bans effectively engage the WTO to ensure that restrictions are science based and are lifted once SPS standards have been met. For example the WHO has stated that, ‘on the basis of presently available data, WHO does not conclude that any processed poultry products (whole refrigerated or frozen carcasses and products derived from them) and eggs in or arriving from areas currently experiencing outbreaks of avian influenza H5N1 in poultry flocks pose a risk to public health’ (WHO 2004f).

As a result, WTO SPS standards allow countries or regions not considered free from NAI to nevertheless export processed meat, viscera and egg products if they have been treated in ways that result in the inactivation of the virus with internationally recognized veterinary and medical certificates to this effect (OIE 2003). However, when the current AI outbreak occurred the EU and Japan banned all Thai poultry including processed poultry imports despite Thai authorities obtaining WHO certificates indicating the products were safe.

An emerging theme in WTO SPS and disease control standards set by FAO and OIE is the zoning and compartmentalisation of production systems. Compartmentalisation and zoning are procedures that define sub-populations of differing animal health status within a territory for the purpose of international trade and disease control. Compartmentalisation applies to a sub-population defined by management criteria while zoning applies when a sub-population is defined on a geographical basis (OIE 2003b). Article 2.1.14.2 of the OIE Terrestrial Animal Health Code states 'a country or compartment may be considered free from NAI when it has been shown that NAI infection has not been present for the past 12 months. If infected poultry are slaughtered, this period shall be 3 months after the slaughter of the last infected poultry' (OIE 2003. p18). This allows countries to re-establish exports after the outbreak of AI from all but the affected zones and compartments which helps to limit the extent of economic impact to the industry.

Alternatives financing options

The alternative strategic approach to address the significant international deficit of funding and motivation for disease control upgrades in developing countries is a punitive or liability system. Unlike the incentives approach described in this paper, which focuses on the global public good aspects of disease control and the non-excludable benefits that accrue to all nations, the punitive approach concentrates on identifying the parties that impose externalities or costs internationally. The EU for example has lead the "polluter pays" approach to the control of animal and plant diseases. The Union has provisions for member states to recover the costs caused by the negligent actions of other parties in relation to animal and plant health (FAO 2004c). Additional conventions such as the Convention on Biological Diversity and the Cartegena protocol contain liability provisions if states are negligent or do not carry out their obligations in relation to the control of new pest or modified organisms.

However, in relation to the financing of SPS and disease control efforts in developing countries the liability approach does not address the capacity gap and lack of resources that constrain governments. Additionally with transnational disease outbreaks such as Avian influenza and potential influenza pandemics with catastrophic economic and population health implications, incentives to prevent disease rather than seek compensation and liability after the fact, are clearly preferable.

5. The Economics of Transboundary animal disease control issues

Appropriate financing systems are critical to ensure that sustained and effective upgrades are made to international disease control activities. While much has been written on the technical and organisational issues raised by transboundary disease such as AI and SARS, few studies have considered the weaknesses of current financing systems which have not been able to create incentives for producers and states to follow international best practice.

The Food and Agricultural Organisation (FAO) defines transboundary animal diseases 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" (FAO 2004c. p6)

Without international intervention, the extent of overall investments made by States will depend on individual risk assessments, and relate to the economic and political importance of the domestic industry and this will inturn depend on its role in food security and nutrition, the importance of export earnings, and the perceived impact of disease on population health and tourism. The nature of government intervention will depend on types of production, be they high intensity facilities (where the individual cost of control relative to income generation as a proportion of income is less significant) or small holding (where the cost of control relative to benefit may be high).

The Asian AI outbreak demonstrated that countries have different levels of risk tolerance and motivation to investment in SPS and disease control. The rapidity, extent and effectiveness of the response to AI during this current outbreak varied in different regions and the reasons for this variation are complex, requireing further detailed analysis. However, an important factor appears to be the incentives for investments in SPS and disease control inherent in a strong export industry. Acting alone, investments will be made by States at a point where the estimated or perceived private marginal cost of controls equals marginal benefit, and the externalities of the international cost of the spread of disease will not necessarily be incorporated in decisions (McLeod 2000). For many resource constrained developing countries that lack agricultural exports particularly to high value destinations such as the EU and USA, the costs of controls can be high, the risk unclear and the benefits not significant enough in the short term to encourage necessary investments. Countries facing competing budgetary pressures and a poultry industry of relative economic insignificance will not have the incentives to invest heavily in disease control.

The AI outbreak in Asia demonstrates that the *public good* characteristics and *externalities* involved in the financing of transboundary disease control, which create a hiatus between private incentives to follow best practice and the international need for effective controls. Economic theories related to such market failures are helpful in understanding the need for intervention and the nature of incentive systems that would reward private and national action towards international disease control objectives.

Disease prevention fits the economic definition of a *public good* as the benefits of activities such as surveillance and the culling of infected animals are non-excludable and non-rival in consumption. The problem that arises in financing such public goods is that non-excludability and non-rivalry create incentives to free ride on the expenditures of others, and to disguise ones private demand for such goods. *Externalities* exist with disease control efforts, as the actions or inactions of producers and countries impose costs and/or benefits on others that are not necessarily considered when making private or national investment decisions (FAO 2004c). Therefore state intervention is necessary and should be proportional to the severity of risk and extent of impact of the disease. Control efforts for AI and similar infections with international animal, human health and economic consequences can be classified as *global public goods* with *global externalities* that require significant and coordinated international action.

The FAO notes that in relation to international transboundary disease control interventions '*additional functions should be provided to developing countries in light of their scarce resources to provide for them, and in light of the externalities that are imposed on other countries if they are absent. These are: enhancing capacity and performance of the [animal] health sector'* (FAO 2004c. p15). Theories on the financing of global public goods argue that core functions such as information, standards and regulations, and research and development should be provided internationally, with other costs being borne by states and producers (Jamison *et al* 1998). *Equity* of financing argues that the costs of control be borne not only by those who create the risk or economic loss but also by those who benefit from control measures (FAO 2004c). As described in this paper, in the case of developing countries, particularly in the face of global disease threats such as AI, there are strong arguments for additional international assistance to support the upgrade facilities.

6. Conclusion

This recent outbreak is a timely reminder of the inter-dependence of trade, agriculture and health at both the national international level in the face of emerging infectious disease threats. The link between AI and human influenza pandemics significantly increases the importance of timely and effective international disease control effort by all nations not simply those affected by AI. The changing epidemiology of zoonotic diseases such as avian influenza, and other communicable diseases such as SARS permanently links the fate of agriculture, human health and economic security and as a result calls for new models of international engagement. An effective response must draw together the agricultural and health sectors of nation states with international institutions such as the World Trade Organisation (WTO), the Food and Agricultural Organisation (FAO), the World Organisation for Animal Health (OIE), and the World Health Organisation (WHO).

External assistance, particularly after the onset of such outbreaks, is likely to have limited impact on the natural course of the disease. It is apparent that the sustained improvements and investments needed for effective response to diseases such as AI require a reorientation of how developing countries approach the financing of such activities, towards viewing these as investments rather than internationally imposed costs. Protecting pre-existing export revenues and expanding new export markets is one of the most powerful incentives for Governments to upgrade agricultural and disease control systems and maintain them once donors leave. However, for this to occur, developing countries need to overcome the financial, technical and political SPS barriers in developed markets that limit agricultural exports and revenues accruing to these regions. To reiterate what was stated in the introduction, whatever the incentives for limiting trade through SPS regulations that existed in the past, the risk to global economic security and human health posed by AI and similar transboundary diseases creates an international imperative to address the economic and political barriers that currently limit incentives for the upgrading of agricultural and disease control systems in developing countries. By assisting developing countries to increase their participation in international trade through the effective engagement of the WTO and SPS system, we encourage them to develop an in-built and self-regulating system for best practice in this area.

Glossary

ADB	Asian Development Bank
AI	Avian Influenza (Bird Flu)

APHCA	Animal Production and Health Commission for Asia and the Pacific
FAO	Food and Agricultural Organisation
HPAI	Highly Pathogenic Avian Influenza
LPAI	Low Pathogenic Avian Influenza
NAI	Notifiable Avian Influenza
OIE	(Office Internationale des Épizooties), World Organisation for Animal Health
SARS	Severe Acute Respiratory Syndrome
SPS	Agreement on the Application of Sanitary and Phytosanitary Measures
WHO	World Health Organisation
WB	World Bank
WTO	World Trade Organisation

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