The World Organisation for Animal Health (OIE)
Prevention and control of animal diseases worldwide

# Economic analysis: Prevention versus outbreak costs

Final Report *(Part I)*

***Prepared by Agra CEAS Consulting***

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## List of acronyms

| | |
|---|---|
| ACIAR: | Australian Centre for International Agricultural Research |
| ADB: | Asian Development Bank |
| AH: | Animal Health |
| AHI: | Avian and Human Pandemic Influenza |
| AHIF: | Avian and Human Influenza Facility |
| AI: | Avian Influenza |
| ALIVE: | ALive Platform, Partnership for Livestock Development, Poverty Alleviation & Sustainable Growth in Africa |
| ANSVA: | National Sanitary Veterinary and Food Safety Authority (Romania) |
| APL: | Adaptable Program Loan |
| ASEAN: | Association of Southeast Asian Nations |
| ASF: | African Swine Fever |
| AUIBAR: | African Union Inter-African Bureau of Animal Resources |
| AusAID: | Australian Government's overseas aid program |
| AUSVETPLAN: | Australian Veterinary plan |
| BIPs: | Border Inspection Posts |
| BSE: | Bovine Spongiform Encephalopathy |
| CAECC: | Central Anti-Epizootic Command Centre (Romania) |
| CBA: | Cost-Benefit Analysis |
| CBPP: | Contagious Bovine Pleuropneumonia |
| COHEFA: | Hemispheric Committee for the Eradication of Foot-and-Mouth Disease |
| CS: | Current Situation |
| CSF: | Classical Swine Fever |
| DALYs: | Disability Adjusted Life Years |
| DEFRA: | Department for Environment, Food and Rural Affairs (UK) |
| EC: | European Commission |
| ECTAD: | Emergency Centre for Transboundary Animal Disease Operations |
| EFSA: | European Food Safety Authority |
| EIU: | Economist Intelligence Unit |
| EMPRES: | (FAO) Emergency Prevention System |
| EU MS: | European Union Member States |
| EU: | European Union |
| EUR: | Euro (currency) |
| FAO: | Food and Agriculture Organisation of the United Nations |
| FAOSTAT: | Statistical Databases from the Food and Agriculture Organization |
| FDL&PCS: | Nigeria Federal Department of Livestock and Pest Control Services |
| FMD: | Foot-and-Mouth disease |
| FVO: | European Commission Food and Veterinary Office |
| GDLN: | Global Development Learning Network |
| GDP: | Gross Domestic Product |
| GEIFA: | Inter-American group for FMD eradication |
| GF-TADs: | (OIE/FAO) Global Framework for Transboundary Animal Diseases |
| GLEWS: | (FAO/OIE/WHO) Global Early Warning System |
| GPAI: | Global Program for Avian Influenza Control and Human Pandemic Preparedness and Response |
| GREP: | Global Plan for the Eradication of Rinderpest |

| | |
|---|---|
| H5N1 | Haemagglutinin type 5; Neuraminidase subtype 1 (Influenza Virus) |
| HCMC: | Ho Chi Min City |
| HDI: | Human Development Index |
| HPAI: | Highly Pathogenic Avian Influenza |
| IAEA: | International Atomic Energy Agency |
| IDAH: | Institute for Diagnosis and Animal Health (Romania) |
| IFPRI: | International Food Policy Research Institute |
| IMF: | International Monetary Fund |
| IS: | Improved Situation |
| IVHPH: | Institute for Veterinary Hygiene and Public Health (Romania) |
| LDCs: | Least Developed Countries |
| MAFRD: | Ministry of Agriculture, Forestry and Rural Development |
| MAP: | Multi-country Adaptable Program Loan |
| MARD: | Ministry of Agriculture and Rural Development |
| MDGs: | Millennium Development Goals |
| MTM: | Malaysia-Thailand-Myanmar |
| N: | Nigerian Naria (currency) |
| NADIS: | National Animal Disease Surveillance System (Nigeria) |
| NEEDs: | National Economic Empowerment and Development Strategy |
| NLPD: | National Livestock Project Division |
| NPV: | Net Present Value |
| NRL: | National Reference Laboratory |
| NSCAI: | National Steering Committee for the Prevention and Control of Avian Influenza (Vietnam) |
| NVRI: | National Veterinary Research Institute (Nigeria) |
| OAS: | Organization of American States |
| OAU: | Organisation of African Unity |
| OECD: | Organisation for Economic Co-operation and Development |
| OFFLU: | OIE/FAO Network on Avian Influenza |
| OIE: | World Organisation for Animal Health |
| OPI: | Integrated Operational Program for Avian and Human Influenza |
| PACE: | Pan African Programme for the Control of Epizootics |
| PAHO: | Pan American Health Organisation |
| PAN: | Nigerian Poultry Association |
| PANAFTOSA: | Pan American Foot-and-Mouth Disease Centre |
| PARC: | Pan African Rinderpest Campaign |
| PCR: | Polymerase Chain Reaction |
| PHEFA: | Hemispheric Program for FMD eradication |
| PPLPI: | Pro-Poor Livestock Policy Initiatives |
| PPR: | Peste de Petits Ruminants |
| PVS: | (OIE) Performance, Vision and Strategy: A Tool for Veterinary Services |
| RCU: | Regional Coordination Unit for FMD in South-East Asia |
| RON: | Romanian currency |
| SANCO: | European Commission Health and Consumer Protection |
| SARS: | Severe Acute Respiratory Syndrome |
| SE Asia: | South East Asia |
| SEAFMD: | Sub-commission for FMD control in South-East Asia |
| SENASA: | National service of livestock, plant health and food security (Argentina) |

| | |
|---|---|
| SOPs: | Standard Operating Procedures |
| SPS: | Sanitary and Phytosanitary |
| STDF: | Standards and Trade Development Facility of the WTO |
| STM: | (FAO/OECD) Short Term commodity Model |
| TADs: | Transboundary Animal Diseases |
| TCP: | FAO Technical Cooperation Programme |
| TRYM: | Treasury macro econometric model |
| UK: | United Kingdom |
| UN: | United Nations |
| UNDP: | United Nations Development Programme |
| UNSIC: | United Nations System Influenza Co-ordinator |
| URAA: | Uruguay Round Agreement on Agriculture |
| US: | United States of America |
| USD: | United States Dollar (currency) |
| USDA | United States Department of Agriculture |
| VLUs: | Veterinary Livestock Units |
| VND: | Vietnam currency |
| VS: | Veterinary Services |
| VSF: | Vétérinaires Sans Frontières |
| VTHs: | Veterinary Teaching Hospitals (Nigeria) |
| WAHID: | (OIE) World Animal Health Information Database |
| WANSCA: | West African Network for the promotion of Short Cycle Animals in rural areas |
| WB: | World Bank |
| WHO: | World Health Organization |
| WTO: | World Trade Organisation |
| YLDs: | Years of life lived with disability |
| YLLs: | Years of life lost |

## Acknowledgements

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[1] Participants in the peer-review process were asked to provide their expert opinion, without necessarily expressing the view of their organisation.

## Executive Summary

### Timing and methodology used

This study was conducted by Agra CEAS Consulting in the period November 2006 to March 2007 with some further updating in September 2007. The work was undertaken using desk research, literature review and construction of a detailed and extensive literature database. It also involved consultations with key relevant institutions/authorities and experts and case studies in 4 countries: Argentina, Vietnam, Nigeria and Romania. Finally a model to provide detailed estimates of the costs of outbreaks (by types of direct and indirect impact) with application to the particular case of HPAI was developed. This enabled the comparison of prevention versus outbreaks costs, so as to derive conclusions on the relative costs and benefits of improving the prevention and control systems in the animal health field.

### Study focus

The focus of this project has been on Transboundary Animal Diseases (TADs), particularly those with high zoonotic potential. Transboundary animal diseases, in the context of this project, 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 co-operation between several countries. The occurrence of such diseases and their control and eradication poses significant challenges for the world's Veterinary Services (VS) and entails substantial socio-economic costs, especially in the context of developing countries' poverty alleviation and development objectives. In addition, many of these diseases have high public health relevance and have become virtually endemic in many parts of the developing world. Due to both its high public health relevance and its significant socio-economic implications, the particular focus of this work has been on Highly Pathogenic Avian Influenza (HPAI). Foot and Mouth Disease (FMD) which has had extensive socio-economic impacts wherever it has occurred and has attracted significant control and eradication efforts and resources is also particularly addressed. The study covers the 132 developing country members of the OIE.

The definition of prevention and control costs, outbreak costs and what would be the benefits of improved prevention and control systems is based on a review of literature, taking the examples of prevention and control strategies currently in place (in particular for HPAI and FMD). The costs of prevention and control include emergency preparedness, human resources, surveillance systems and vaccination. Disease outbreak costs are broken down into direct cost and losses in the form of direct production costs of various kinds as well as control costs and indirect impacts in terms of ripple and spill-over effects as well as impacts on wider society. The review and assessment of the various costs involved in prevention and in the event of disease outbreak are outlined in detail by type of costs.

### Conclusions and model results

The review of the literature indicates clearly that when a comparison of prevention versus outbreak costs is made, the majority of the reviewed studies conclude that the significant benefits that accrue from improved prevention and control measures outweigh the cost of investment. Thus, for example, in Latin America investment in improvements to animal health of some additional US$ 157 million per year over

15 years generates a Net Present Value of US$ 1.9 billion. In Africa it has been estimated that an investment of Euro 14.7 to control CBPP could save Euro 30 million in losses from morbidity/mortality, leading to a net benefit of Euro 15.4 million and in Asia eradication programmes for FMD have been assessed to provide benefits in terms of improved trade and market access that are worth several times the investment. While specific results need to be treated with caution and clearly depend on what underlying assumptions are made and the methodological tools used (it is noted that the analysis which can be defined as a full classical cost benefit analysis is relatively limited in this field), the nature of the relationship between outbreak costs compared to the costs of prevention is indisputable and is validated by the four case studies on this issue which were undertaken for Argentina, Vietnam, Nigeria and Romania.

Drawing on this analysis the report provides a global overview of prevention costs versus outbreak costs for HPAI using a specific analytical tool incorporating a baseline, scenarios and assumptions on key parameters from which to estimate the detailed direct and indirect costs of a disease outbreak.

At a country level the "most likely", "low impact" and "high impact" scenarios vary in terms of the duration of the impact of the epidemic and the intensity of disease spread within countries. At a global level the three scenarios used are formulated on the basis of the geographical coverage of the disease worldwide, with scenario A including only H5N1 infected countries, scenario B infected and 'non infected at immediate risk' countries, and scenario C all developing/transition countries that are members of the OIE.

The range of outcomes in relation to **direct costs and losses** under the different scenarios are as follows:

The results for scenarios A and B tend to be very similar, reflecting the relatively small number of countries added under scenario B, given the current state of HPAI outbreaks worldwide. If this position changes, with a more substantial geographical spread of the disease, then the impact would start moving closer to the substantially higher figures of scenario C. Thus, total direct costs and losses (excluding consequential on-farm losses) in scenarios A and B are estimated at US$ 5.3 billion and US$ 6.1 billion respectively (on an annual basis), but would rise up to US$ 9.7 billion if the disease were to spread throughout the developing world. Including consequential on-farm losses, the total direct impact would be US$ 11.7 billion and US$ 13.5 billion respectively in the case of scenarios A and B, but could rise up to US$ 21.3 billion if the disease was to spread more worldwide along the lines suggested by scenario C. It is noted that in all cases, the impact is not proportionate to the number of countries added under each scenario, because the countries of scenarios A and B account for 55% and 63% respectively of the poultry stock of all developing OIE country members.

The various **indirect costs** in the event of an HPAI outbreak have been estimated as a range between 3 possible outcomes from the 3 main scenarios ('most likely', 'low impact' and 'high impact'). Global estimates of the indirect impact under the 'most likely scenario' are presented on an annual basis and in total terms (i.e. depending on the duration of the impact of the epidemic). Under the 'most likely' scenario, ripple costs are estimated at US$ 5.3 billion in terms of domestic market losses in the poultry sector and a further US$ 3.8 billion in terms of export market losses on an annual basis. Assuming a 2 year duration of impact, as is currently the case under the 'most likely' scenario based on real market baseline trends, the total ripple impact in terms of domestic and export market losses in the poultry sector would be double the above amounts (i.e. to US$ 10.6 billion and US$ 7.5 billion respectively).

The considerable extent to which the relative value of spill-over (tourism) and wider society (human pandemic) costs outweigh the ripple effects is also highlighted. In the case of spill-over effects in the tourism sector alone, these are estimated to amount to US$ 72 billion on an annual basis under the 'most

likely' scenario and double that amount assuming a 2-year duration of the impact (i.e. US$ 144 billion). Wider society costs, in the event of a human pandemic, are several multiples of all costs, and depending on the severity of the outbreak these are estimated at US$ 311.2 billion (at 15% attack rate), and at US$ 711.2 billion (at a 35% attack rate) on an annual basis alone. It should be noted that these costs exclude certain types of indirect impacts for which it has not been possible to provide estimates on a global scale. Such impacts include ripple effects on upstream/downstream industries (raw material suppliers, catering and distribution, wholesale markets, employment in the sector etc.), spill-over effects (e.g. on the services industry) and other wider society costs (e.g. environmental effects).

In conclusion it is important to note that the aim here has been to develop a flexible tool, rather than solely providing estimates as such. This means that the baseline, the assumptions and the scenarios can be improved/refined at any point in time, as further research and evidence on a disease impact becomes available. This tool allows a flexible approach, which highlights the relative importance of the various direct and indirect impacts, so as to provide direction to policy-making in this field.

It should also be noted that in this study this tool has been developed specifically for the case of HPAI, but it has the potential to be adapted for application in the case of other TADs such as FMD.

# The report in brief

## Timing and methodology used

The work on Part I of this project was conducted by Agra CEAS Consulting in the period November 2006 to March 2007 with some further updating in September 2007. The work was undertaken using desk research, a literature review and construction of a detailed and extensive literature database. It also involved consultations with key relevant institutions/authorities and experts and case studies in 4 countries: Argentina, Vietnam, Nigeria and Romania. Finally a modelling tool to provide detailed estimates of the costs of outbreaks (by types of direct and indirect impact) with application to the particular case of HPAI was developed. This enabled the comparison of prevention versus outbreaks costs, so as to derive conclusions on the relative costs and benefits of improving the prevention and control systems in the animal health field.

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## Analysis steps

### *Classification and definitions*

The study starts with a classification of the countries (by GDP, trade status) and the nature of the farming systems in place (commercial, back yard), to highlight the importance of these factors in defining the appropriate prevention and control strategies and in establishing the impact of animal diseases.

A review of the current prevention and control strategies in place, in particular for HPAI and FMD, provides the basis for the definition of prevention and control costs, outbreak costs and what would be the benefits of improved prevention and control systems.

For the purposes of the analysis, **prevention and control costs** have been defined as the costs incurred by governments during 'normal' times, i.e. in advance of outbreaks. In particular, these include:

- Emergency preparedness, in terms in particular of the existence of emergency preparedness plans and the state of VS more generally,
- Surveillance networks, in terms in particular of diagnostic capacity and border controls.

For the definition of **outbreak costs** a differentiation was made between direct costs and losses, and the various indirect costs and losses as follows:

**A. Direct impact**

The total direct cost of a disease is the sum of the production losses (direct and consequential) and the costs of disease control, as follows:

- **Direct losses:** These stem either from the disease itself, or from sanitary control measures (stamping-out policies). In addition to the loss from the value of animals culled as such, there are culling and disposal costs.
- **Control costs: S**uch costs during and after the outbreak typically include equipment, facilities, disinfectants, protective clothing, staff in quarantine stations etc. They may also include (ring) vaccination where this is considered appropriate and is available.
- **Other direct production losses**: Consequential on-farm losses include losses due to the fall in stock, to restrictions of movement when zoning restrictions are put in place, and due to the loss in animal value.

**B. Indirect impact**

The indirect impact of livestock diseases includes ripple effects, spill-over effects and costs to the wider society including longer term macro-economic effects. These costs are defined as follows:

- **Ripple effects:** Ripple effects include impacts on livestock and livestock product prices and on upstream and downstream activities along the livestock value chain upstream and the producer: breeding, feed production, input supply, production, collection and trade (of eggs or live birds), slaughter, processing, final sale and consumption.
- **Spill-over effects:** Apart from agriculture as such and the impact of diseases along the affected livestock sector's value chain, tourism and services are the two other sectors most likely to be severely affected. The macro-economic impact can consequently be severe if these two sectors are important in the economy. In addition, as already indicated, animal diseases can have major effects on food availability and quality for poor communities and therefore raise issues of food security, as well as having negative effects on poverty alleviation.
- **Wider society:** Developing or transition countries, which tend to have inadequate/inefficient public health systems, are particularly exposed to the risk of zoonoses on public health. In the particular case of a pandemic, a large proportion of the economic losses are caused by higher morbidity and mortality rates in the human population and by its repercussions on the world economy.

On the other hand, three main **benefits** of improved prevention are most widely explored in the available literature. These are as follows:

1. **Enhanced food security / poverty alleviation.** This includes the benefits accrued from productivity improvements and generally improved production systems.
2. **Improved market access**
3. **Savings in potential outbreak costs**

In terms of the first objective, it is important to note that an estimated 600 million poor people worldwide rely directly on livestock production for their livelihoods. Several parts of the developing world, most notably sub-Saharan Africa, are still below the recommended protein diet levels and only get a fraction of the daily livestock protein intake of industrialised countries. In addition, each year the population of developing countries grows by an estimated 72 million, with the highest growth rates in Africa and in Asia, adding to the demand for food products. Average annual per capita consumption of all meats in the developing world is thus projected to increase to 30 kg, which represents an increase by about a third on 1993 levels. Improved animal health not only guarantees food supplies but is also considered to be a major factor for productivity gains in the livestock sector.

In terms of the second objective, trade in livestock and livestock products makes up approximately one sixth of global agricultural trade. Most of these exports (nearly 80%) currently come from the developed world. On the other hand, the least developed countries are estimated to account for only less than 5% of total world meat exports by value. Within this overall picture only a few countries account for the bulk of exports from the developed world: 90 % of exports of beef and poultry (70% for pork) come from 5 countries. This having been said, it is widely acknowledged in the available literature that big gains are possible for the developing countries from the removal of sanitary barriers now that post URAA tariff barriers have been reduced and that these opportunities are likely to expand if tariff barriers are further reduced in the ongoing WTO and bilateral negotiations. Within this evolving policy outlook, the improvement in SPS conditions for developing country exporters or potential exporters has become an issue of utmost importance (as well as being an obligation under the WTO SPS Agreement).

***Literature review***

This definitional work was followed by an extensive review of the literature on the costs of prevention and control including emergency preparedness, human resources, surveillance systems and vaccination. In this context the study comes to the following conclusions on the relevance of country preparedness to prevention and control costs:

- The costs of improved prevention and control for the major TADs will depend *inter alia* on the current level of preparedness in the various countries;

- Existing data from international surveys (OIE, UNSIC) and other literature suggest that there are considerable differences in approach and status quo between developing/transition countries, notably in terms of the overall state of Veterinary Services, preparation of prevention and control plans for specific diseases (e.g. HPAI), available and well-trained veterinary staff, epidemio-surveillance networks, border controls, diagnostic capacity, and vaccination;

- In the context of countries' international obligations within the overall framework for the prevention and control of major TADs, as defined by the OIE, the varying levels of preparedness

and prevention systems between countries indicate the need to define priorities and assess gaps on a country by country basis. In the case of vaccination the policy debate on the appropriateness and conditions for application of this method is currently on-going;

- This has implications in terms of the budget required in each country to enable it to arrive to an optimal surveillance system.

The literature review also indicates clearly that when a comparison of prevention versus outbreak costs is made, and it must be said that there is relatively little analysis which can be defined as a full classical cost benefit analysis, the majority of the reviewed studies conclude that the significant benefits that accrue from improved prevention and control measures outweigh the cost of the investment. Thus, for example, in Latin America investment in improvements to animal health of some additional US$ 157 million per year over 15 years generates a Net Present Value of US$ 1.9 billion. In Africa it has been estimated that an investment of Euro 14.7 million to control CBPP could save Euro 30 million in losses from morbidity/mortality, leading to a net benefit of Euro 15.4 million. In Asia eradication programmes for FMD have been assessed to provide benefits in terms of improved trade and market access that are worth several times the investment. While specific results need to be treated with caution and clearly depend on what underlying assumptions are used the nature of the relationship between outbreak costs compared to the costs of prevention is indisputable and is validated by the four case studies which were undertaken.

***Case study results[2]***

**Argentina:**

The FMD campaign undertaken in South America during 1999-2004 has demonstrated the value of regional action when the control of TADs of major economic importance to the region is being sought. It also demonstrates the significance of maintaining the investment when pockets of resistance remain which risk to erupt to full blown outbreaks in countries of the region. Some US$ 3.5 billion have been committed on the fight against FMD by South American countries during 1990-2004, which is considered to have contributed to an effective control of the disease during this period. Against this, in the space of only a year, the 2000/01 FMD outbreak in Argentina has resulted to losses in beef export revenue alone of US$ 439 million.

Preliminary results of on-going cost-benefit analysis of improvements in Argentina's and wider Latin American VS (OIE Regional Representation/CEMA) suggest that there are significant benefits in terms of both productivity gains and potential trade gains from investing in such improvements, and that the final outcome in terms of NPV and welfare gains justifies the investment. For example, increased expenditure

[2] *The benefits highlighted in the case studies assume that a certain investment will result in productivity gains and exports. The scale of the benefit is conditional on the effective design and implementation of the investment to be undertaken, leading to an effective control of the disease (eradication is questionable as there is a significant risk factor that the disease would re-appear, as has been the general experience). The above calculations do not take into account the incremental operational costs involved, which can be a significant part of the cost of strengthening VS. On the other hand, the investment in strengthening the control of a particular disease, e.g. HPAI, can have important spill-over benefits on the entire VS.*

of some US$ 18 million in Argentina's VS would result in productivity gains of US$ 20 million per year, and additional annual exports of 260.000 tonnes of meat.

**Vietnam:**

The country suffers from a number of high risk factors with respect to HPAI. Consequently the government has committed significant national resources (including donor support) to the fight against avian influenza and for the prevention of a human pandemic. This has included extensive restructuring in the VS since the 2004-05 AI outbreaks, although there is little information to date on whether this has resulted in improvements that can effectively prevent/control future outbreaks (a recently concluded PVS evaluation is bound to shed more light on this). Our analysis and comparisons of data on the committed national budgets for 2006-10 under the Operational Programme for avian influenza (animal health component) against real and projected costs of the outbreaks reveal the relative scale of the costs and benefits involved. These conclusions are supported by other work reviewed from available literature. For example:

- The total commitment on animal health under the 2006-10 OPI (excluding control costs in the event of an outbreak) comes to some US$ 70 million for the 5 year period, while the total direct and indirect costs from the outbreak in 2004 alone is (conservatively) estimated at US$ 300 million.

- Investing in disease investigation and strengthening VS over the same period would cost public coffers a total US$ 30 million, compared to total direct production costs and losses during the 2004-05 outbreak of US$ 62 million a year and excluding consequential on-farm losses.

- Adding consequential losses, our projections of the total direct impact under the most likely scenario (which is milder than the 2004-05 epidemics) come to US$ 115 million a year.

In a country where two thirds of the production is run by small holder systems and over two thirds of farms keep poultry, this analysis also demonstrates the potential benefits of improved prevention in terms of social equity and poverty alleviation (and even food security). Relatively the largest direct losses were felt by small scale, often indebted, commercial chicken producers, while Vietnam's millions of farm households with small numbers of poultry were also affected. Against this, investment in bio-security is estimated to require at least US$ 500 million for minimum improvements in the next 10 years, a cost prohibitive to small rural farmers.

**Nigeria**

The experience of Nigeria in this area is relatively more recent and more limited compared to Vietnam. However, both the government and the international community are concerned of the potential risks and ramifications of these outbreaks in the context of the extensive presence of rural/urban backyard farming, relatively weak biosecurity, and the socio-economic importance of the sector.

Our analysis and comparisons of data on the planned commitments for 2006-10 under the WB integrated plan for the control and eradication of avian influenza as well as under the ALIVE needs assessment for Nigeria, against real and projected costs of the outbreaks, reveal the relative scale of the costs and benefits involved. For example:

- The total commitment on animal health under the 2006-10 WB plan (excluding control costs in the event of an outbreak) comes to some US$ 22.6 million for the 5 year period (or an average US$ 4.5 million per year), while the direct costs from the outbreak in part of last year alone is (conservatively) estimated at US$ 8.4 million and excluding consequential on-farm losses.

- Investing in strengthening disease surveillance and veterinary quarantine would cost a total US$ 10 million over the same period, or US$ 2 million a year which is less than 25% of the above conservative estimate.

- The relative scale of the costs is even more evident when adding consequential losses, with our projections of the total direct impact under the most likely scenario (which is milder than the 2006 epidemic) reaching US$ 113 million a year.

In a country where two thirds of the official (registered) production is run by small holder systems and poultry rearing is central to the survival of poor rural and urban communities, this analysis also demonstrates the potential benefits of improved prevention in terms of poverty alleviation and food security.

**Romania**

The country's VS have undergone significant restructuring and upgrading in the run up to EU accession (Romania became an EU member on 1 January 2007). Having suffered a large number of outbreaks since 2004, this country was relatively recently declared HPAI-free.

Our analysis and comparisons of data on the planned commitments for 2006-09 under the WB integrated plan for the control and eradication of avian influenza, against real and projected costs of the outbreaks, reveal the relative scale of the costs and benefits involved, and the interest in investing further in improved structures and surveillance systems. For example:

- The total commitment on animal health under the 2006-09 WB plan (excluding control costs in the event of an outbreak) comes to some US$ 12.6 million for the 3 year period (or an average US$ 4.2 million per year), while the direct costs from the outbreak in the six months of the 2005-06 outbreak alone were estimated at US$ 67.6 million, excluding consequential on-farm losses (**Error! Reference source not found.**).

- Investing in strengthening disease surveillance and diagnostics would cost a total US$ 11 million over the same period, or US$ 3.6 million a year which is less than 0.5% of the above conservative estimate.

- The relative scale of the costs is even more evident when adding some ripple and spill-over effects, bringing the total impact at some US$ 211.6 million, as a consequence of the effects of the October 2005 to May 2006 outbreak.

***Modelling of outbreak costs***

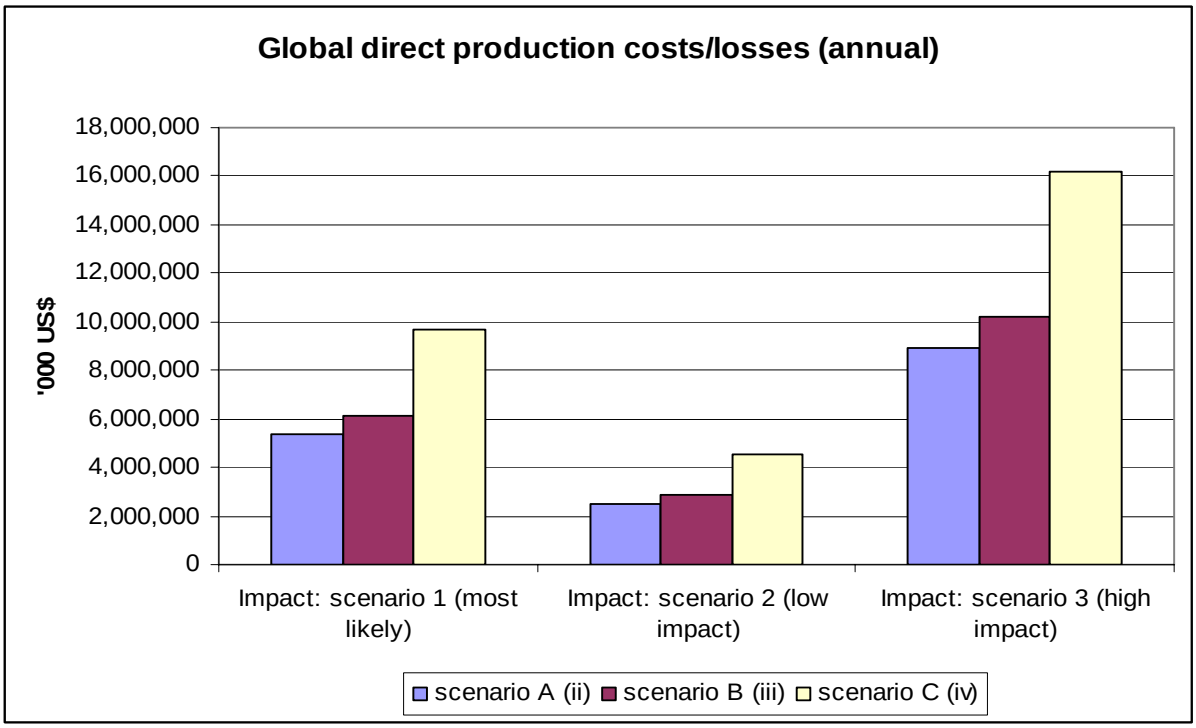
Drawing on the analysis undertaken in the previous steps, the study provides a global overview of prevention costs versus outbreak costs for HPAI by developing a specific analytical tool incorporating a

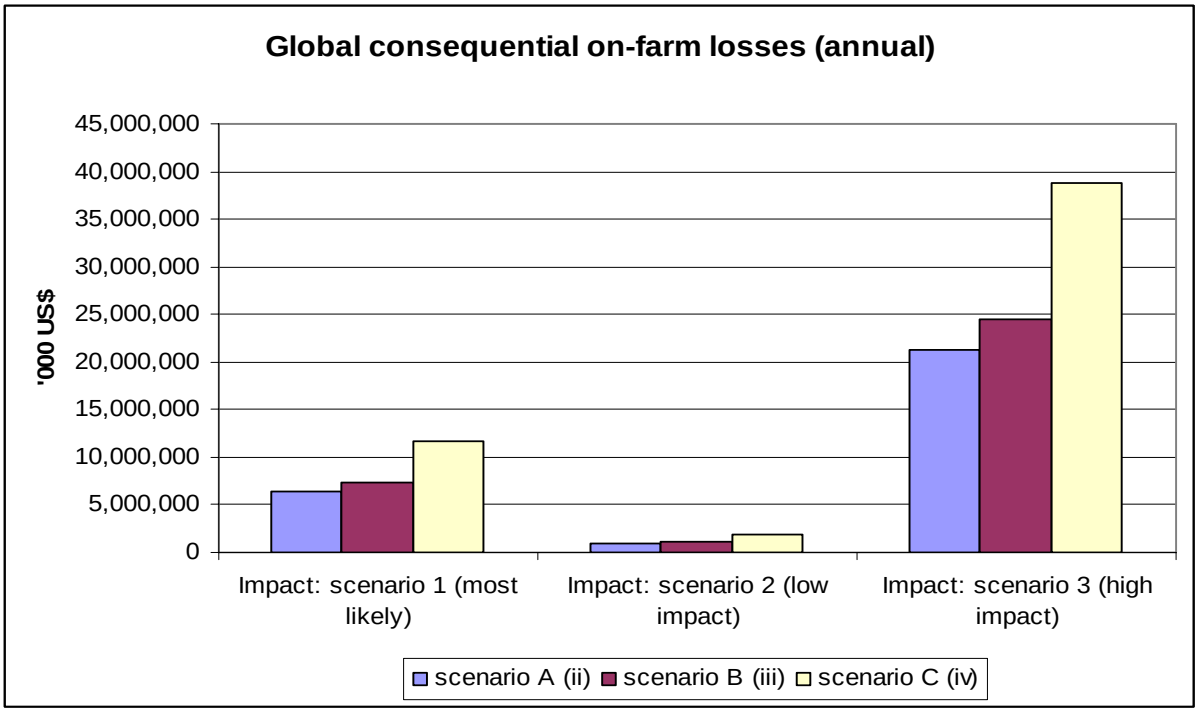
baseline, scenarios and assumptions on key parameters from which to estimate the detailed direct and indirect costs of a disease outbreak.

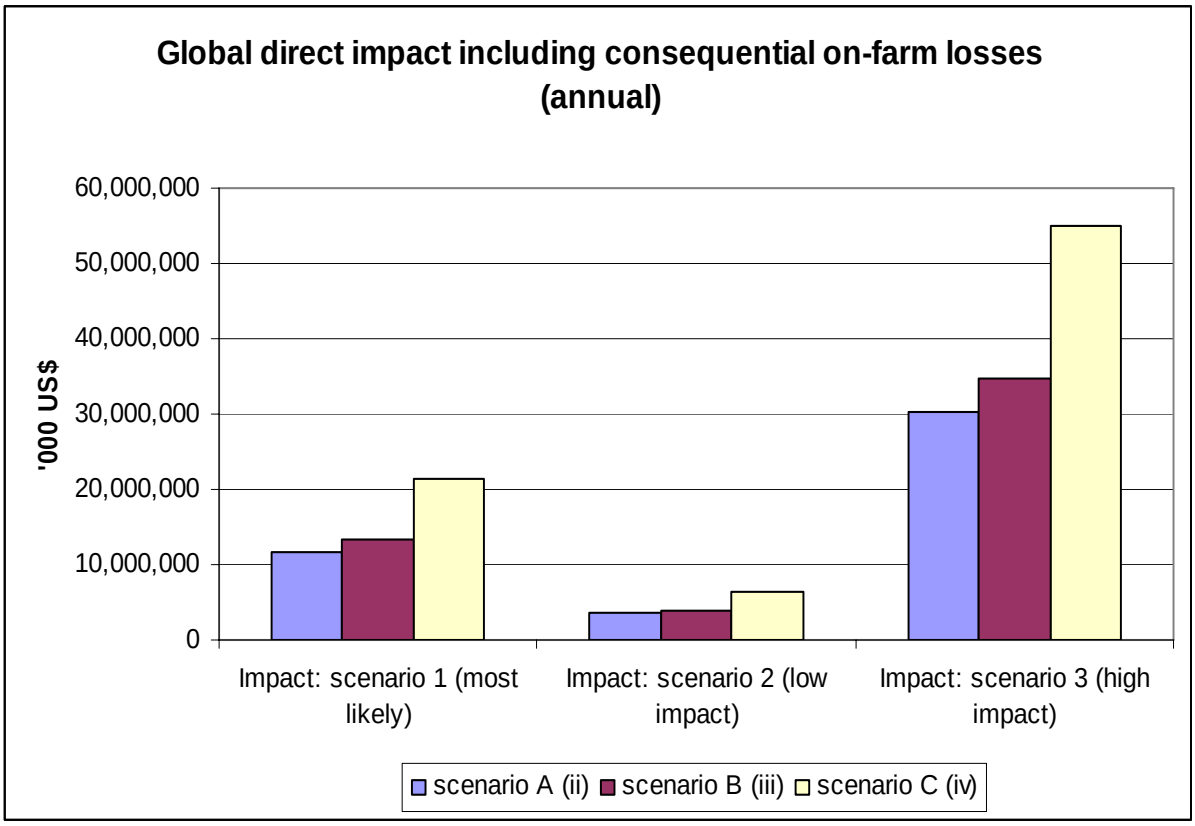
At a country level the "most likely", "low impact" and "high impact" scenarios vary in terms of the duration of the impact of the epidemic and the intensity of disease spread within countries. At a global level the three scenarios used are formulated on the basis of the geographical coverage of the disease worldwide, with scenario A including only H5N1 infected countries, scenario B infected and 'non infected at immediate risk' countries, and scenario C all developing/transition countries that are members of the OIE.

The range of outcomes in relation to **direct costs and losses** under the different scenarios are indicated in **Figure A**. The results for scenarios A and B tend to be very similar, reflecting the relatively small number of countries added under scenario B, given the current state of HPAI outbreaks worldwide. If this position changes, with a more substantial geographical spread of the disease, the impact would start moving closer to the substantially higher figures of scenario C. Thus, total direct costs and losses (excluding consequential on-farm losses) in scenarios A and B are estimated at US$ 5.3 billion and US$ 6.1 billion respectively (on an annual basis), but would rise up to US$ 9.7 billion if the disease were to spread throughout the developing world. Including consequential on-farm losses, the total direct impact would be US$ 11.7 billion and US$ 13.5 billion respectively in the case of scenarios A and B, but could rise up to US$ 21.3 billion if the disease was to spread more worldwide along the lines suggested by scenario C.

**Figure A: Overview of estimated direct impacts under the different scenarios, HPAI (i)**




Global consequential on-farm losses (annual)
'000 US$
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Impact: scenario 1 (most likely)
Impact: scenario 2 (low impact)
Impact: scenario 3 (high impact)
scenario A (ii)
scenario B (iii)
scenario C (iv)


Global direct impact including consequential on-farm losses (annual)
'000 US$
60,000,000
50,000,000
40,000,000
30,000,000
20,000,000
10,000,000
0
Impact: scenario 1 (most likely)
Impact: scenario 2 (low impact)
Impact: scenario 3 (high impact)
scenario A (ii)
scenario B (iii)
scenario C (iv)

*Notes:*
*(i) Includes animal value losses, culling/disposal and control costs*
*(ii) Scenario A includes the following countries: Cambodia, China, Indonesia, Laos, Thailand, Vietnam, S. Korea; Mongolia, Kazakhstan, Russia, Turkey, Romania; Nigeria, Niger, Sudan*
*(iii) Scenario B includes the countries of scenario A plus: N Korea, Malaysia, Brunei, Myanmar, Singapore, Philippines; Bangladesh, Bhutan, India, Nepal, Sri Lanka*
*(iv) Scenario C includes all developing/transition countries, members of the OIE (132 countries in total)*

Source: *"OIE Del1 global costs analysis.xls"*, Agra CEAS Consulting.

The various **indirect costs** in the event of an HPAI outbreak have been estimated as a range between 3 possible outcomes from the 3 main scenarios ('most likely', 'low impact' and 'high impact'). Global estimates of the indirect impact under the 'most likely scenario' are presented on an annual basis and in total terms (i.e. depending on the duration of the impact of the epidemic). Under the 'most likely' scenario, ripple costs are estimated at US$ 5.3 billion in terms of domestic market losses in the poultry sector and a further US$ 3.8 billion in terms of export market losses on an annual basis. Assuming a 2 year duration of impact, as is currently the case under the 'most likely' scenario based on real market baseline trends, the total ripple impact in terms of domestic and export market losses in the poultry sector would be double the above amounts (i.e. to US$ 10.6 billion and US$ 7.5 billion respectively).

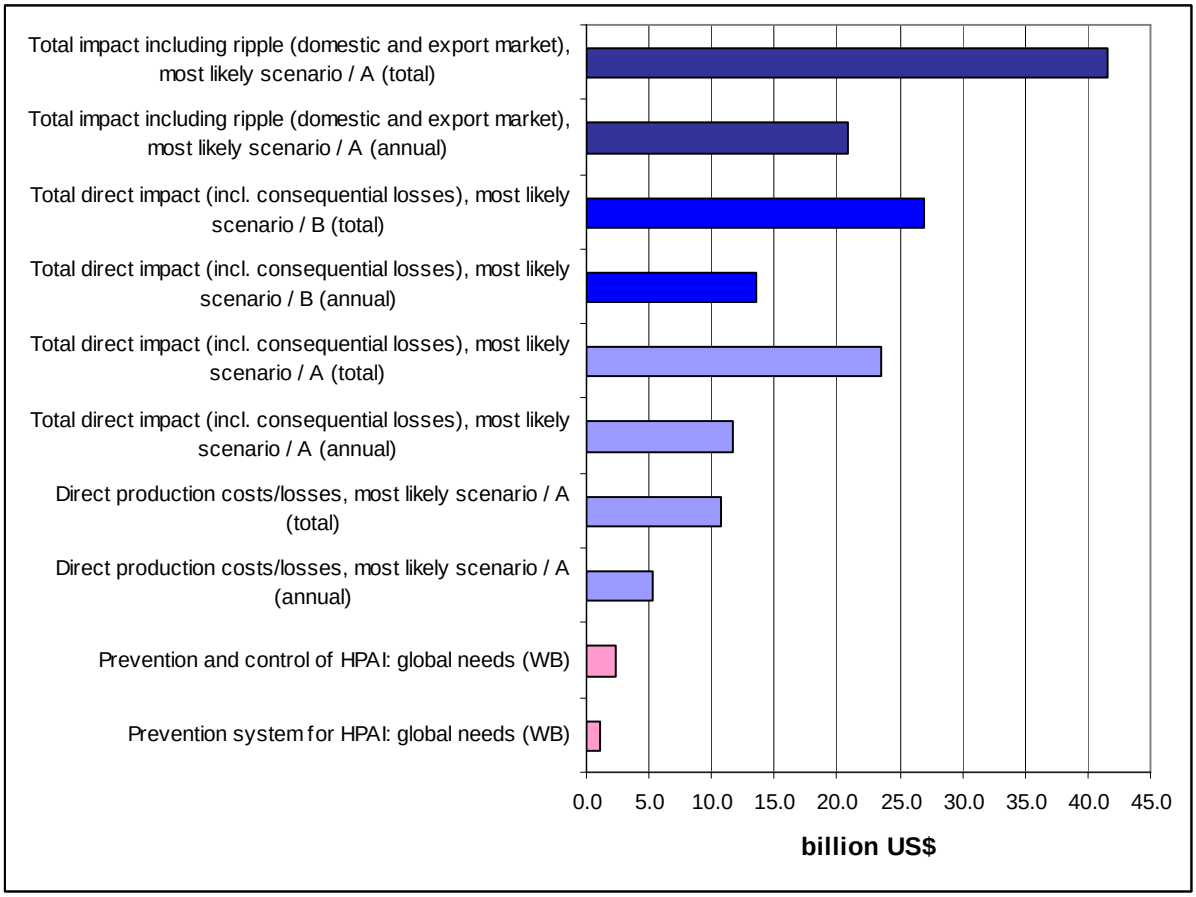
The considerable extent to which the relative value of **spill-over** (tourism) and **wider society (human pandemic) costs** outweigh the ripple effects is also highlighted. In the case of spill-over effects in the tourism sector alone, these are estimated to amount to US$ 72 billion on an annual basis under the 'most likely' scenario and double that amount assuming a 2 year duration of the impact (i.e. US$ 144 billion). Wider society costs, in the event of a human pandemic, are several multiples of all costs, and depending on the severity of the outbreak these are estimated at US$ 311.2 billion (at a 15% attack rate), and at US$ 711.2 billion (at a 35% attack rate) on an annual basis alone. It should be noted that these costs are the minimum expected outcomes, as they exclude certain types of indirect impacts for which it has not been possible to provide estimates on a global scale. Such impacts include ripple effects on upstream/downstream industries (raw material suppliers, catering and distribution, wholesale markets, employment in the sector etc.), spill-over effects (e.g. on the services industry) and other wider society costs (e.g. environmental effects).

In this context it is noted that the aim of this study has been to develop a flexible tool, rather than solely providing estimates. This means that the baseline, the assumptions and the scenarios can be improved/refined at any point in time, as further research and evidence on a disease impact becomes available. This tool allows a flexible approach, which highlights the relative importance of the various direct and indirect impacts, so as to provide direction to policy-making in this field. It should also be noted that in this report this tool has been developed specifically for the case of HPAI, but it has the potential to be adapted for application in the case of other TADs such as FMD.

Comparing the global cost of prevention and preparedness with that of an outbreak in the case of HPAI, the most recent global needs assessments of prevention and response to HPAI suggest that some US$ 2.27 billion would be required over a 3-year period. Of this amount, prevention and preparedness costs as such account for just over US$ 1 billion. Against this assessment, outbreak costs under the 'most likely' scenario and for H5N1 countries only are estimated at US$ 5.34 billion per year for the direct production costs and losses alone (excluding consequential losses) (**Figure B**). Adding consequential on-farm losses, the total direct impact comes to US$ 11.75 billion per year. Assuming the impact of an outbreak spread

over a period of 2 years ('most likely scenario') the total direct impacts would be US$ 10.7 billion excluding consequential on-farm losses and US$ 23.5 billion if these losses are included. Moving towards scenarios B and C these costs increase further to US$ 12.3 billion and US$ 26.9 billion respectively (in the case of scenario B) and to US$ 19.4 billion and US$ 42.7 billion respectively (in the case of scenario C). Before even considering the indirect impacts the benefits of improved prevention therefore by far outweigh the potential outbreak costs and losses.

**Figure B: Prevention versus outbreak costs: comparison under various scenarios, HPAI**




*Notes:*
*HPAI global needs figures are totals over a 3 year period;*
*Incremental operational costs (a significant part of the total costs of strengthening VS) are excluded from these calculations, due to lack of data;*
*Outbreak costs are quoted in annual and total amounts (total here refers to the duration of the impact, which is assumed to last for 2 years in the most likely scenario).*

Source: *"OIE Del1 global costs analysis.xls"*, Agra CEAS Consulting.

The report concludes by noting that it is difficult to predict the severity of the threats posed by TADs. Moreover, different issues arise depending on the nature of the disease. A disease such as HPAI, with its high public health relevance, poses a different set of challenges than a disease such as FMD which has

purely commercial and socio-economic implications. Both diseases, however, have the potential to lead to substantial and even devastating consequences in terms of increased poverty, the loss in food security and social equity/stability in developing/transition countries.

At the same time, the current state of Veterinary Services (VS) and preparedness levels in developing/transition countries pose a real and present threat to the prevention and control of TADs. As is demonstrated in the case studies and from the literature review, the various identified weaknesses essentially revolve around the key issue of the lack of funds and/or poor governance. Within a weaker economic environment and while these countries are struggling to catch up with the rest of the world, it is evident that VS have not been – more importantly have not consistently been – a priority in the use of relatively constrained public funds. Today more than ever, with increasing globalisation, the world's 'developed' and 'developing/transition' countries are so interconnected that both the effects of TADs and the measures to prevent them cannot be viewed in isolation. This calls for a global approach in the fight against animal diseases and it is clear that the veterinary services have a crucial role to play here, both in 'peace' time and during crisis situations, as the providers of Global Public Goods.