



The economic and social impact of the Institute for Animal Health's work on Foot and Mouth Disease



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Contents

1.	Introduction	1
2.	Foot and Mouth Disease: overview	1
3.	The activities of IAH	2
3.1	'Market failure' approach	2
3.2	FMD-related research at IAH	3
3.3	Contribution to global FMD control	4
4.	Economic impact assessment - UK	5
4.1	Willingness to pay for IAH activities on FMD	5
4.2	Wider economic impact of IAH activities on FMD	8
5.	Summary and Conclusions	11



1. Introduction

DTZ was commissioned by the Institute for Animal Health (IAH) to conduct a case study investigating the impact of IAH's work on foot and mouth disease (FMD). This short report offers a brief description of the disease's characteristics and effects, a review of IAH's global activities, and an assessment of the resulting economic impacts in the UK.

2. Foot and Mouth Disease: overview

The virus

FMD is a highly contagious viral disease caused by a ribonucleic acid (RNA) virus in the same family as polio virus of man. The disease primarily affects cattle, pigs and sheep but other cloven hoofed animals can also be affected including various wildlife species. Humans very rarely catch the disease.

Although FMD can be fatal, most animals recover. The issue with FMD is that it is highly contagious, transmissible by contact as well as via the breath of infected animals. The virus can even travel by wind, especially in humid conditions. FMD can have a devastating effect on agricultural production through lower growth rates, lower fertility and reduced milk production.

Control measures introduced following outbreaks include restriction zones, quarantine, destruction of infected and at-risk livestock, and export bans on meat and other animal products. There is much debate about the need to slaughter recovered animals as they probably represent a very low risk for further disease spread. However, the UK's policy has always been to do so, in order to guarantee designation as FMD free.

Vaccination is available for FMD. However, the vaccine must be highly specific to the strain, as there is large variation between FMD viruses. Vaccination only provides temporary immunity of about six months, while different countries are affected by different strains.

Recent outbreaks

The World Organisation for Animal Health (OIE) has established an official list of FMD free countries and zones. The list names countries that are FMD-free without vaccination, FMD-free with vaccination, countries that have an FMD-free zone without vaccination and countries that have FMD-free zones where vaccination is practised. The first group on the list contains 57 countries, which have an advantage on the export markets of meat and other animal products.

There have been three significant FMD outbreaks in the United Kingdom in recent years. The first one happened in Shropshire in 1967, where the source was identified as imported lamb from Argentina. During the second, most serious FMD crisis in 2001, six million animals were destroyed in the UK, including 4.9 million sheep, 0.7 million cattle and 0.4 million pigs. The outbreak cost an estimated £8 billion to the economy. The third outbreak happened in August 2007, was much more contained, but still affected agricultural trade.

3. The activities of IAH

3.1 ‘Market failure’ approach

IAH is a publicly financed research centre, which receives funding from two UK Government bodies, Defra and the BBSRC (Biotechnology and Biological Sciences Research Council). The institute is seeking to address what is known as a ‘market failure’.

The OECD defines a **market failure** as a “*situation in which market outcomes are not optimal. Market failures provide a rationale for Government intervention*”¹. The activities of IAH address market failure, since they produce outcomes that the market alone would not deliver.

The table below shows the activities of IAH and the market failures they address.

IAH activity	Market failure addressed	Nature of market failure
UK & international government advice	Public good	There is not enough incentive for individuals to pay for the full costs of FMD research and advice, as everyone benefits from it. This would create a “free-rider” problem if farmers were left to develop their own methods or a sub-optimal outcome if best practice is not commonly shared.
Surveillance and vaccination research	Externalities	If left alone, the private sector would under invest in this kind of research, as the costs are high, the probability of success is uncertain, and the benefits associated with it only arise during an outbreak. However, the benefits to society are desirable, and can be delivered cost-effectively when centrally managed.
Disease control training	Asymmetric information / Natural monopoly	The agricultural sector does not have full understanding of the disease, the best ways to prevent an outbreak and minimise the costs. A central repository of information is therefore required. Given the scientific expertise required, IAH is able to deliver this more effectively than individual companies, as an increased concentration of expertise maximises the chance of success.

¹ <http://stats.oecd.org/glossary/detail.asp?ID=3254>



3.2 FMD-related research at IAH

The FMD programme is the largest programme at IAH. It addresses both national and international disease control, and involves basic and applied research. The funding of the programme is diverse; its sponsors include Defra, BBSRC, the EU, the FAO and private sector companies.

IAH's global role is recognised in its designation as:

1. The European Community Reference Laboratory for FMD
2. The World Reference Laboratory for FMD (designated by the FAO)
3. The FMD reference laboratory for the World Organisation for Animal Health (OIE)

Across these roles, the Institute has responsible for three core types of activities relating to FMD:

- National and international disease surveillance and risk assessment;
- Research to improve basic understanding of the disease leading to better diagnostics, vaccines and control strategies; and
- Advice to national and international authorities on disease control.

Each of these is now discussed in turn.

3.2.1 National and International disease surveillance

IAH provides an international diagnostic service through its **World Reference Laboratory for FMD** that includes virus detection and strain characterisation; it holds the world's largest repository of strains and characterisation data. The Laboratory maintains global surveillance for the disease to help predict and prevent its spread across international borders. For example, the laboratory provides recommendations on the most appropriate vaccines and identifies the need for new vaccine strains to be developed.

In the UK, IAH provides a **24 hour emergency service** for the diagnosis of FMD. It applies the latest diagnostic methods to more rapidly detect and characterise the virus (for example pen-side tests and forensic tracing of virus spread) and it advises the government on the selection and quality of its vaccine reserves.

3.2.2 Research

IAH carries out extensive research to continuously improve our ability to detect and characterise the disease agent and to predict and model its spread and the effectiveness of different disease control measures. An example of this work is the development of pen-side tests so that diagnosis can be done in the field, speeding up the process and leading to more effective control measures as well as reducing unnecessary culling of unaffected animals.

Another example is work to provide a strategy for and confidence in the use of existing vaccines so that trade restrictions do not prevent their being used to reduce culling. A third and major goal is the development of improved vaccines. This work includes improving stability of vaccines in hot climates as well as increasing their short-term protection from up to six months to a year, which, if achieved, would mean a significant reduction in costs to farmers or governments.

3.2.3 Disease control

IAH provides expert **advice to UK Government** on all aspects of FMD control and helps to provide training and to develop contingency plans in peace-time as well as to select and implement control policies when outbreaks occur.

IAH also has a **major role in providing expert advice to international disease control agencies**. For example, IAH is designated as the European Community Reference Laboratory for FMD, as the World Reference Laboratory by FAO and as the coordinator of the World Animal Health Organisation's network of international FMD Reference Laboratories. In these roles it advises on both policy (for example the development of international trade rules and EC legislation) and control (for example missions to assist countries dealing with outbreaks of FMD and training and technology transfer to national FMD laboratories worldwide). This has a far-reaching impact on international FMD control and international trade in animals and their products.

3.3 Contribution to global FMD control

The developed third of the world have the resources to achieve and maintain FMD freedom. This creates trade advantages, since other countries will accept imports of their livestock and meat. The remaining two-thirds are at a trade disadvantage, but also pose a threat to the FMD free countries in the event of an outbreak. It is therefore mutually advantageous to work towards regional and ultimately global disease control, by preventing the spread of the disease from the source.

IAH aids in this process through:

- Technology transfer, helping countries establish the laboratory facilities required to combat FMD; and
- Surveillance, which develops an understanding of which strains of the virus circulate and where. This allows grouping of regions that are most at risk from particular strains into more effective regional control schemes. This potentially offers far more effective control than individual actions by the participating regions.

This process helps to safeguard the global stock and trade levels. At present, when one region experiences an outbreak, its exports are likely to be curtailed. However, this loss of exports from one country is likely to be off-set by a corresponding increase in an unaffected region. To date, these redistribution effects have particularly disadvantaged the Third World and particularly Africa, who lack the resources to effectively combat the disease. By working towards global FMD control, IAH is helping to improve and encourage the sustainability of Third World agricultural economies.

4. Economic impact assessment - UK

To estimate the economic impact of IAH's FMD-related activities, we have followed the guidance of HM Treasury, which is published in the Green Book².

We can measure the value of IAH activities in relation to FMD through society's willingness to pay for IAH advice and through the estimation of the potential scale of losses to industry if IAH was not available to provide advice on FMD.

4.1 Willingness to pay for IAH activities on FMD

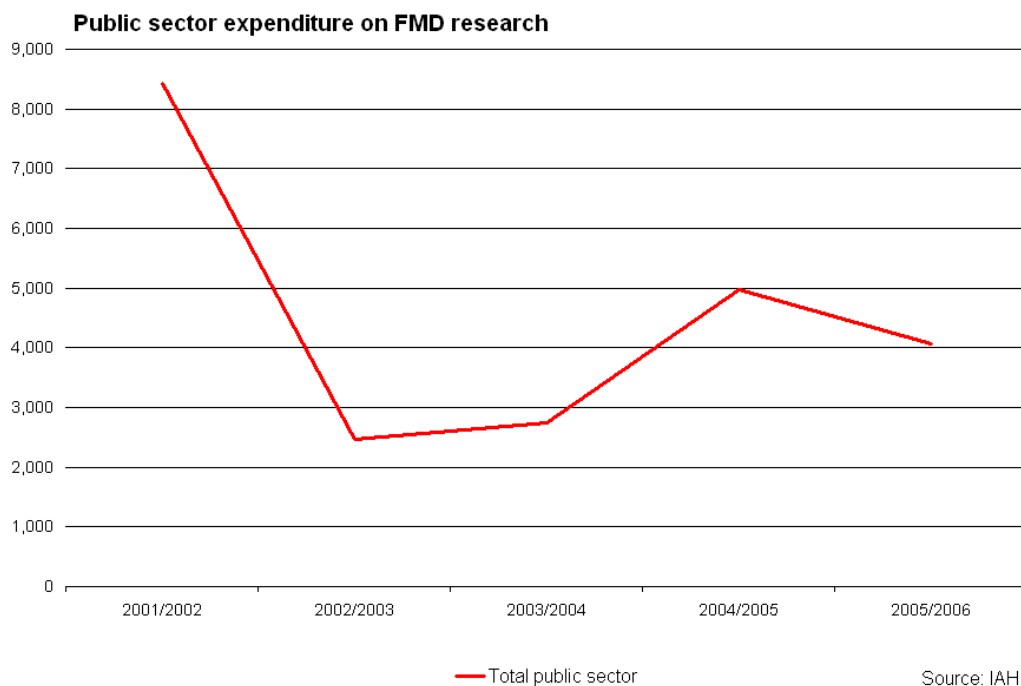
Society's willingness to pay for IAH activities on FMD can be estimated firstly through:

- Government funding made available
- Costs of training and awareness

These areas are considered below.

4.1.1 IAH FMD funding

During the five years 2001 to 2006, the total amount paid by the public sector for IAH's FMD-related research was **£27.2 million**, equal to an average annual amount of **£4.5 million**. However, the amount paid each year fluctuated, as seen in the chart below:



In 2001/2002 there was a significantly larger amount spent by the public sector on FMD related activities than in the years that followed. The reason was expenditure associated with

² http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_index.cfm

the 2001 FMD outbreak, and the £8.5 million of additional Defra funding towards disease control activities: principally diagnostic testing. This demonstrates that Government is more willing to pay for preventative measures during and immediately after an outbreak, and pays much less in other years.

This finding is a clear indication of market failure: there is reactionary spend immediately after a crisis. In the absence of IAH, there would have been no obvious alternative organisation to offer the advisory role to UK Government, to best target their response to the outbreak. **The peak year of spend following the FMD outbreak of 2001 was £8.5 million.** This can be taken to be the Government's willingness to pay to avoid the adverse consequences of an outbreak. In other words, they have valued the potential losses as being in excess of the value of prevented. This gives a proxy for the minimum impact of the Institute's FMD activity.

4.1.2 Training and awareness

In addition to their core advisory role to national and international control bodies, IAH holds wider training and awareness events on FMD free of charge. Examples of such events include:

- Defra's periodic stakeholder meetings with farmers' representatives
- Meetings with NFU officials themselves
- Locally organised workshops, for example, 2007 FMD lessons workshop organised by Surrey County Council, Brussels FMD workshop and Pirbright workshop in May 2006
- Other dissemination events such as the EU project on FMD and classical swine fever that includes stakeholder involvement

It is likely that other events and workshops are organised around the country by vets, consultants and farmer representatives, using IAH-based research to disseminate the latest information on FMD.

By their willingness to attend, farmers, vets and others are demonstrating a value assigned to these services, that value being the *opportunity cost* of their time. If we make the following assumptions, an estimate of the value of the time of those involved is shown in the following table:

- two dissemination events per month across the UK that make use of IAH FMD research
- each event attended on average by 50 farmers 10 vets and 2 scientists
- each event lasts half a day – this equates to 12 training days per year

	Training days	No. Attending	Employee days	Total sector output £m	Output per day £m	Total employees	Output/day /employee £	Sacrificed output £
Vets	12	10	120	97,042	266	2,061,000	129	15,480
Farmers	12	50	600	21,008	58	223,000	258	154,800
Scientists	12	2	24	7,241	20	103,000	193	4,632
Market value of training activities								174,912

This approach shows that the value of time given up in an average year for FMD related training is nearly £180,000. These results are based on 2004 prices. In 2007 prices this means an expenditure of around **£200,000 per annum**. This represents willingness-to-avoid potentially negative consequences of an outbreak on the part of the industry itself.

On top of that, the agricultural sector spends an annual £7m on inputs from the education sector³ (training, seminars...). According to a Defra survey in 2003, 16% of farmers considered the provision of research and advice by the Government as a high priority. While this survey primarily related to organic farming, it is likely to point to a much higher level of interest in FMD. This proportion is likely to increase dramatically during an animal disease outbreak. If we make the assumption that in times of an outbreak, such as the recent FMD outbreak, half of the farming industry's expenditures on education deal with training on the disease affecting the country's livestock, another **£3-4m** can be added to the industry's willingness-to-avoid these potential negative impacts.

In summary, society's willingness to pay for services involved in research, training, and prevention of FMD in the UK amounts to £11.5-12.5m per year, composed of:

- Public grants awarded to IAH for FMD research in a peak year: **£8.5m**
- Output given up for FMD training and awareness: **£3-4m**

³ http://www.statistics.gov.uk/about/methodology_by_theme/inputoutput/

4.2 Wider economic impact of IAH activities on FMD

4.2.1 Surveillance and vaccination

To estimate the wider economic impact of preventative measures, such as research into vaccination, surveillance and on the spot testing, we have considered the largest UK outbreak so far, for which there is good information on the number of animals affected and slaughtered. We assume that the impacts of another outbreak, without the measures introduced by IAH, would have a similar effect.

First of all, the total value of UK livestock is calculated. The total value of cattle, pigs and sheep in the UK is **£7.15 billion** (see table below):

UK livestock 2007	Number	Price £	Value £m
Beef	7,442,000	459	3,418
Dairy	2,862,000	902	2,582
Ewes	16,064,000	25	399
Other sheep	17,881,000	35	632
Pigs	4,834,000	25	120
Total	49,083,000		7,150

Defra statistics state that 4.9 million sheep, 0.7 million cattle and 0.4 million pigs were slaughtered as a result of the 2001 outbreak. About 4 million of the animals were culled as part of disease control (1.3 million on infected premises, 1.5 million on farms defined as dangerous contacts not contiguous with the infected premises, and 1.2 million on contiguous premises, many of which were also defined as dangerous contacts).

Using the 2001 outbreak figures, the table below shows the percentage of UK livestock that could be affected.

UK livestock 2001	Number	Slaughtered (number of animals)	Slaughtered (% of livestock)
Cattle	10,602,000	700,000	6.6%
Sheep	36,716,000	4,900,000	13.3%
Pigs	5,845,000	400,000	6.8%
Total	53,163,000	6,000,000	11.3%

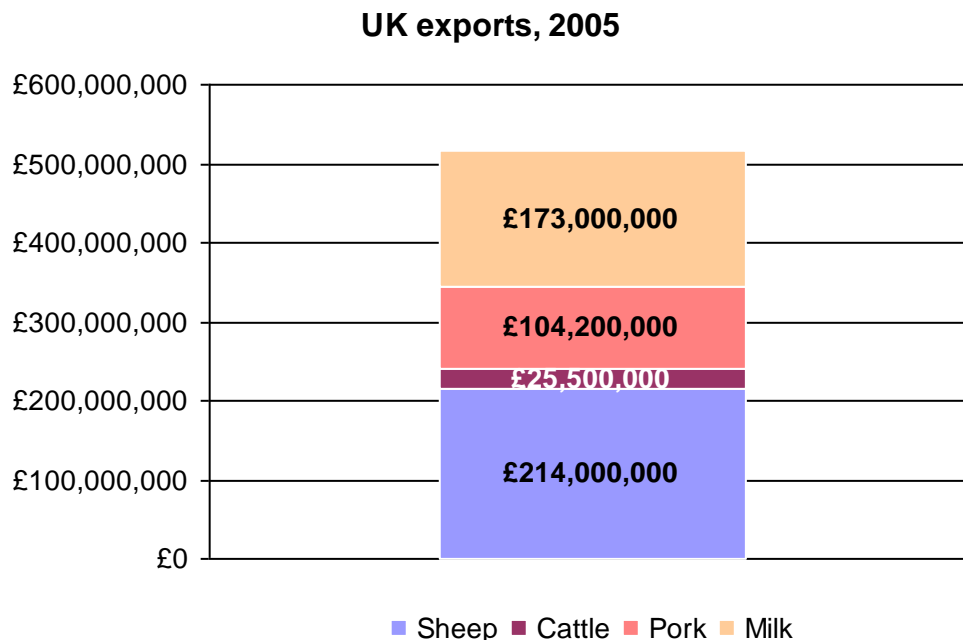
If 11.3% of UK 2007 livestock were slaughtered, this would result in the loss of **5,541,000** animals, worth **£542 million**.

In 2001, 45% of slaughtered animals were defined as dangerous contacts. This would mean that the slaughter of **2,494,000 animals** could be saved through the advances made by IAH in surveillance measures, such as on the spot testing and vaccination. Assuming an equal distribution of different kinds of animals on infected farms and in dangerous contact, this could save **£244 million** to the UK economy.

4.2.2 Restrictions on UK agricultural exports

In 2006, according to the 2007 DEFRA statistics, the United Kingdom exported 44,000 tonnes of cattle, 100,000 tonnes of sheep, as well as 627 million litres of milk, to the rest of the EU (plus a very small proportion of it to rest of the World)⁴.

We estimate the value of the UK's exports of cattle in 2005 at £25.5m, the value of exports of sheep at £214m, the exports of pork at £104m, and the exports of milk at £173m, making a total export value of **£516.5m**.



If we assume similar export restrictions to those applied following the 2001 and 2007 outbreaks i.e. restrictions on exports of all ruminants, pigs, and fresh meat, the impact could therefore reach **£343.5m** losses for UK farmers over the course of a year.

IAH's work ensures that any outbreak is minimised and that export restrictions are imposed for the minimum time. If we assume that IAH work allows export markets to be re-opened six months earlier than would otherwise have been the case, the value to the UK economy will be **£172m**.

⁴ <http://statistics.defra.gov.uk/esg/publications/auk/2006/excel.asp>

4.2.3 Employment impacts

Basing our model on the National Accounts published yearly by the ONS (Office for National Statistics), we can assess the employment implications of such output losses on the national labour market.

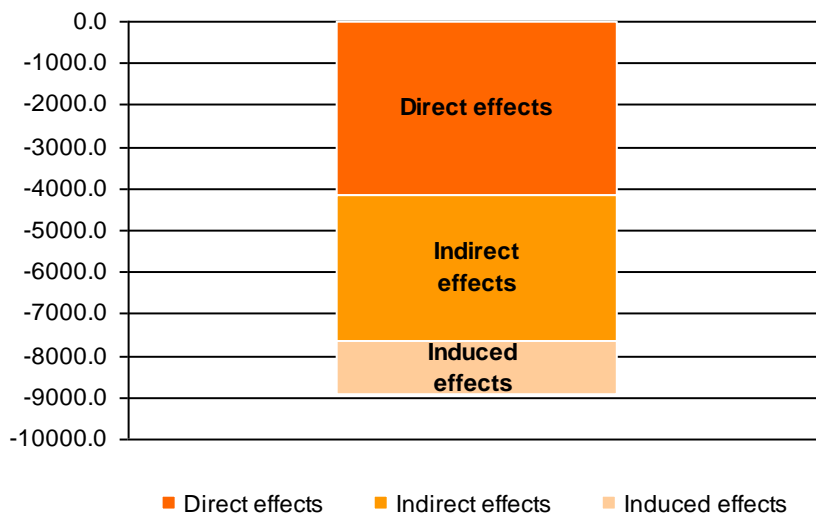
The **direct employment impacts** of such an outbreak, if it was not prevented, would amount to the loss of **4,200 jobs** in the UK Agricultural sector.

The **indirect employment impacts**, capturing the links between the agricultural activity and the others sectors of the UK economy, would translate into another **3,500 job losses** in the industrial sectors supplying agriculture at the national level in machines, chemical products, animal feeding, etc.

The **induced employment effects**, which are the consequences of the decrease in national consumption, due to the 8,500 job losses mentioned above, and the income losses associated with them, would add another **1,300 job losses** in the UK economy.

The overall employment impacts of such an FMD outbreak in the UK, without the intervention of IAH and their partners to stop the disease from spreading would therefore represent about **9,000 job losses** throughout the UK economy.

Employment losses from an FMD outbreak in the UK



5. Summary and Conclusions

By encouraging trade, or mitigating trade embargos, the IAH is facilitating an improvement in the global movement of livestock and meat. In particular, this contributes to the development and sustainability of Third World agricultural economies, which are disproportionately affected by such restrictions, given their relative inability to instigate an effective response to outbreaks.

The perceived value of IAH work in the UK, captured through an estimation of the willingness to pay for the services that IAH provides in terms of research, prevention, training and awareness is **£11.5-12.5m per annum**.

By mitigating an outbreak of FMD, IAH work could save **£244 million** in livestock value during a major outbreak. In addition, through ensuring re-opening of export markets more quickly, IAH could protect **£172m** in export market value. On top of that **9,000 jobs** would be protected throughout the UK's economy that would otherwise be lost.

