
The role of economics in developing and appraising animal health and welfare policy

FINAL REPORT

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An economic framework for developing & appraising animal health and welfare policy

Prepared for the Department of Food and Rural Affairs

by

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Executive summary

1. This project was commissioned by Defra to examine the potential for economic analysis to contribute to the understanding, formulation and implementation of policy in England relating to the health and welfare of animals, and to consider the role of economic analysis in offering guidance in the assembly of the evidence base used in the development of animal health and welfare policies.
2. The programme of research was conducted in four stages; (i) a review of literature, (ii) a workshop to consider policy mechanisms for animal health and welfare, (iii) the development of a framework for policy development and (iv) the testing of that framework through a series of case studies.
3. For animal health and welfare there is little published in relation to policy design and implementation. The relatively large bodies of literature relating to human health policy were found to be of little direct relevance to animal health and welfare, principally because of the less direct impacts of animal health and welfare (cf. human health) upon human well being. Useful texts exist for environmental policy design and implementation, and for more general forms of regulation, and these were used to inform the development of the framework for animal health and welfare policy development.
4. The workshop highlighted many issues pertinent to animal health and welfare policy. Discussions commenced at the workshop (and continued thereafter) between policy makers, veterinarians and economists proved highly valuable in developing and in testing the framework.
5. The framework was developed from existing models of the policy decision making process and is similar to frameworks used, for example, for planning the regulation of public utilities. The framework is supported by a series of tables, providing the user with more detailed guidance on policy design. Issues include rationales for government intervention, strengths and weaknesses of a selection of interventions, possible policy instruments and suggested appraisal criteria. The framework together with these tables was seen as a working document; that was refined through the case-study process and has proved a valuable tool in the consideration of policy options.
6. Review of the case-studies highlighted a range of factors to be considered in developing animal health and welfare policy, including the importance of a clear objective underpinning policy, and of a recognition and understanding of the context into which a policy would be introduced, as well as more subtle factors such as the impacts that changes in understanding of a disease might have upon policy design.
7. The role of economics in developing and evaluating animal health and welfare policies proved far wider than cost-benefit analysis alone. The assessment of animal health and welfare issues within a formal framework, and calling upon economic concepts, illuminated the structure and possible solutions to these issues in a different but complimentary way to, for example, their consideration in purely veterinary terms.
8. The concept of 'optimal' policy mechanisms was found to be insufficient in relation to animal health and welfare, principally because there are such wide ranges of objectives, of target audiences and of sectors to be taken into account. However, the assessment of policies against criteria of effectiveness, efficiency, equity and sustainability set out within a formal framework allowed for the development of *satisficing* policy mechanisms.
9. Recommendations are given for the categorisation of animal health and welfare issues according to criteria designed to speed the identification of similar disease or welfare issues and the policies which have been used for control; for continued support of monitoring and surveillance activities; for field-testing of the framework for policy development within a real policy environment and for the use of the framework to assess novel policy instruments which may be applied to animal health and welfare issues.

1. Terms of reference

Background

The Animal Health and Welfare (AHW) Strategy for Great Britain published in mid-2004 recognises that enhanced animal health and welfare is not an outcome that can or should be achieved by government in isolation but requires the active participation of the private sector working in partnership with the state. State intervention in the areas of animal health and welfare has a long history in the UK and takes a variety of forms; examples include statutory and regulatory controls, compensation for slaughter of diseased animals and border surveillance. Against a backdrop of deregulation, liberalisation of the economy as a whole and public expenditure controls over the last quarter century the presumption that the current balance between public and private sector responsibilities for animal health and welfare represents an optimal position requires careful examination.

Research objectives

1. To produce a scoping study, applying to England, identifying i) gaps in knowledge regarding the economic analysis of AHW policy, ii) areas where further research by economists would yield high returns in terms of improving policy formulation and iii) restraints on economic analysis of policy in terms of data availability and the state of scientific knowledge.
2. To deliver an analytical framework for addressing AHW policy problems in rigorous economic terms.
3. The output to include the core of an agenda for further research both of the economics of AHW and the priority areas for the development of the evidence base.

Specific objectives are:

- i. To review the literature on market failure diagnosis and the rationale for public intervention in AHW.
- ii. To consider the options for managing the risks associated with prevention or control of animal diseases and to assess the extent to which market based solutions are viable options.
- iii. To develop a set of decision rules, grounded in economic analysis, for identifying the conditions and circumstances in which state intervention would produce more efficient outcomes than the market.
- iv. To identify the respective strengths and weaknesses, in terms of their economic efficiency and distributional implications, of different mechanisms for existing state intervention.
- v. To advise on the design of optimal policy mechanisms for delivering improved AHW: this should include novel policy instruments based on the price mechanism.
- vi. To devise criteria for judging the optimal level of state interventions against the base-line of current activities.
- vii. To identify the types of policy problems amenable to, and offering the highest returns from, public intervention.
- viii. To advise on the information requirements (evidence base) necessary for the design of optimal policies in AHW.

2. Introduction

The importance of animal health and welfare

The post-war years have seen substantial changes in mans' relationship with animals. The technical progress that has increased the availability of food has also resulted in demographic and lifestyle changes that have significantly altered the way in which animals are viewed.

Whilst farming practices have reached levels of industrialisation previously unknown, they have also been restrained more than ever before by public concerns over animal welfare. The utility of farm animals purely as producers of foodstuffs has been challenged by their utility as 'sentient beings'. Companion animal and horse ownership has increased as has the size and scale of animal welfare charities.

The last fifty years have seen a vast change in the patterns and productivity of UK livestock farming. A combination of better feeding, improved genetics and more skilful management have all contributed to making UK livestock farming increasingly technically efficient. However, gains in farm animal health and welfare have been inconsistent, with some issues such as lameness, mastitis and fertility in dairy cows improving little, if at all, in this time.

The livestock sector is now going through a period of dramatic and rapid structural change and is becoming an industry with fewer players. External pressures such as CAP reform, trends towards world (cf local) trade, consolidation of the slaughter and processing sector and of the food retail sector will lead to a tighter and better focussed industry that will have a far closer relationship with its markets than ever before. These markets, consisting of the multiple retailers, the food processing and the catering sectors will expect certain standards of animal health and welfare to be the norm. That is to say, the customers of the retailers and of the catering industry will expect these outlets to provide a level of assurance that the goods and services which are purchased do not unacceptably compromise animal welfare. Welfare-friendly branded produce is increasingly widely available through major retailers and the Eurobarometer Survey (TNS, 2005) found 57% of respondents were willing to pay more for eggs from an animal welfare friendly production system¹.

As consumers have become more affluent there has been substantial growth in companion animal and horse ownership. In the mid-1960s there were an estimated 4.7 million dogs and 4.1 cats respectively within the UK. By 2003 the estimated numbers were 6.5 million dogs and 9.2 million cats (Pet Food Manufacturers Association, 2006). The equine population is estimated at 965,000 (British Horse Society, 2006). Animal welfare charities receive considerable public backing. In 2004 the RSPCA alone had an income of over £87 million, whilst four² of the primarily 'animal rescue and shelter' charities together received income in excess of £70 million (Charities Commission, 2006). Furthermore, there is a substantial private policing of animal welfare in the UK, with the RSPCA expending over £35 million in the same period on its inspectorate, prosecutions and operational support (RSPCA, 2005)

These changing attitudes and patterns of ownership and influence also impinge upon matters of animal health; not only because of the clear impacts that health has upon welfare, but because they reflect very real changes in individual rights and responsibilities. Arguably, farming needs to move away from reliance on State aid towards a more market-oriented approach – already apparent in the pig and poultry sectors. The livestock industries need to take greater responsibility for the health and welfare of their animals, working in partnership with government and other stakeholders. Companion animal ownership has historically involved less government intervention (with a few exceptions such as quarantine regulations for rabies control) but there have been arguments for a greater degree of intervention to safeguard welfare, as evidenced by the Animal Welfare Bill.

¹ Although this was not seen at the point of purchase due to insufficiently clear labelling of food products.

² The Blue Cross, National Canine Defence League (Dogs Trust), Battersea Dogs Home and Wood Green Animal Shelter

Government policies relating to the health and welfare of animals have developed within a historical context and against backgrounds of subsidised agriculture, emerging disease situations, evolving and changing public attitudes to animal health and welfare and wider European and international trade agreements.

There can be a high cost for Government intervention. Defra is likely to have spent an estimated £270 million in 2004-2005 on animal health and welfare. The cost to Government of the BSE and FMD outbreaks were in excess of £3.3 billion³ (Defra, 2006) and £3 billion (Comptroller and Auditor General, 2002) respectively. However, the political, social and economic contexts in which animal health and welfare policies must now operate are very different from when many of these policies were first introduced. Therefore it is desirable to reassess animal health and welfare policies over time, particularly concerning the degree of government intervention, the most appropriate policy instruments to use and their costs and benefits to society. In a time of substantial structural change within the livestock industry, and of relative wealth for the companion animal sector it may be possible to manage animal health and welfare issues using different measures to those now in place.

There is increasing recognition within government and industry of the disconnection between the beneficiaries of policies and the structure, application and costs of these policies. The Government position is clear "the distribution of costs should not only better reflect where the balance of responsibilities lie for managing the risks, but also take account of those who benefit from measures to manage them" (Defra et al, 2004).

The role of economics

The Animal Health and Welfare Strategy, launched in June 2004, was developed by Defra, the Scottish Executive and Welsh Assembly Government. The Strategy aims to develop a new partnership with animal keepers and other stakeholders to continuously improve the health and welfare of kept animals while protecting society, the economy and the environment from the effects of animal diseases. Defra and the devolved governments each have their own implementation plans for the Strategy. The Strategy has five key strategic outcomes which are:

- Working in partnership
- Promoting the benefits of animal health and welfare: prevention is better than cure
- Ensuring a clearer understanding of costs and benefits of animal health and welfare practices
- Understanding and accepting roles and responsibilities
- Delivering and enforcing animal health and welfare standards effectively

Economic concepts and analysis can help with all of these strategic objectives. They can also help to inform policy makers and others regarding institutional arrangements for working in partnership. Economic analyses can help to demonstrate to stakeholders the benefits of better animal health and welfare in terms of increased returns to producers and benefits to livestock industries, the economy and society generally. Economic analysis of disease control strategies, husbandry and biosecurity measures involving estimation of the costs and benefits of different measures to improve health and welfare can help stakeholders to better understand these costs and benefits and who in society they fall upon. This can also aid a better understanding and acceptance of roles and responsibilities - i.e. based on the distribution of benefits and costs and where liabilities are created (e.g. for the application of the polluter-pays-principle). Finally, an economic input can help to appraise policy instruments and mechanisms for the delivery of animal health and welfare improvements and the relative efficiency and effectiveness of alternative methods. It is the

³ Figure to 2005, including EU receipts

contribution of economics to developing and appraising animal health and welfare policy that much of this study addresses.

There is often some misunderstanding by non-economists as to what economics is concerned with. In particular, the layman is often tempted to equate economics with financial accounting. This is misleading, since the discipline of economics is far more fundamental to the analysis of public policy and its implementation. Economics is concerned with the allocation of scarce resources to alternative uses for the benefit of human welfare.⁴ Animal health and welfare policy often needs to tackle complex and interrelated impacts on animal production systems, animal welfare, human health, markets and international trade, wildlife and the environment. Hence the development of and choice between alternative animal health and welfare strategies is an economic problem as much as it is a scientific, veterinary, or political problem.

In the past, the economic considerations surrounding animal health and welfare issues have been neglected and their importance not generally acknowledged by veterinarians and policy makers. This has now changed and there is greater acknowledgement of the importance of economic considerations and the need for information on the economic aspects of animal health and welfare, including information on the relative merits and limitations of different policies and policy instruments (for further reading see references in the Literature Review, p. 6).

Economic aspects of animal health and welfare

Disease in livestock is a problem because of eight main impacts;

- i) A reduction in the level of marketable outputs
- ii) A reduction in (perceived or actual) output quality
- iii) A waste (or higher level of use) of inputs
- iv) Resource costs associated with disease control and prevention
- v) Human health costs associated with diseases (zoonoses) or with disease control
- vi) Negative animal welfare impacts associated with disease and its control
- vii) International trade restrictions due to disease and its control
- viii) Indirect effects of disease and its control on wider society and the environment.

All of these are characterised by a relatively high level of risk and uncertainty.

Animal welfare is determined not only by disease but by other factors (ranging from breeding to slaughter), notably by how animals are kept and how they are treated by humans and the level of care given to them. The perception of animal suffering reduces human welfare, and economics as a discipline is concerned with issues such as the extent to which people would choose to pay, for example in higher prices for animal products, to reduce such suffering. Moreover, poor animal welfare can reduce the output and quality of the goods and services derived from animals, whilst additional resource costs may be involved in the pursuit of improved animal welfare – and both of these are amenable to economic analysis.

A number of the aspects of animal health and welfare mentioned above give cause for government intervention. For example, the disease control decisions taken at the individual animal keeper level may have external effects (both positive and negative) on (a) disease risks for other animal keepers (b) human welfare through food safety and risks to human health (c) human welfare through perceived animal suffering (d) wider effects on society and the environment (e.g. pollution, effects on wildlife etc.). The existence of such 'externalities' may go unrecognised by market systems and can be difficult (or

⁴ Measured in principle by people's informed preferences, rather than any presupposition of what those preferences ought to be.

impossible) for individuals or groups within society to do anything about, sometimes resulting in substantial costs to society generally. This provides a clear reason for government intervention on behalf of society to address such problems. There are also goods and services that society wants and that benefit society generally but if left to the market would not be adequately supplied. These are termed public goods (e.g. provision of law and order, national defence). The protection of national borders against disease from other countries is such a public good in the context of animal health, as are protection of public health and animal welfare.

The Animal Health and Welfare Strategy for Great Britain (Defra et al, 2004) gives four main reasons for government intervention in animal health and welfare. These are:

- i) to protect public health (zoonoses)
- ii) to protect and promote the welfare of animals
- iii) to protect the interests of the wider economy, environment and society
- iv) to maintain the UK's ability to trade internationally

The main reasons for government intervention in a market based economy are as follows;

1. The presence of negative externalities (which are not taken account of in markets) - such as environmental pollution, disease spread and animal suffering.
2. Market imperfections or distortions - such as monopoly power and anti-competitive behaviour.
3. The absence of property rights – which, for example, might lead to over-use of a resource.
4. The provision of 'public goods' – such as public health and animal health and welfare.
5. The desire for particular social goals which the market is failing to achieve – such as justice, fairness and equity.
6. Information lack and asymmetries – i.e. which prevent markets from functioning properly.

(see also the more comprehensive listing in Table 1, p.14)

The challenge for animal health and welfare policy makers is to identify the main reasons for government intervention for any particular problem, and to decide on its nature and extent. This will depend on the strength of the various reasons for government intervention and the merits and limitations of different policy instruments that might be used. This is where economists have a role to play in contributing to policy analysis and assessment.

This study therefore attempts to guide policy makers as to the role that economics and economists might play throughout the policy decision making process, starting with a simple framework for appraisal of policy instruments for government intervention in animal health and welfare.

Literature review

There is an extensive literature relating to animal disease and its control, by veterinarians and economists. However, a data-base search, of about 300 items, showed that most reports are devoted to specific disease problems in particular circumstances. Publications relating to the individual case studies will be referred to in that context. There are relatively few publications relating to the more general issues of animal health policy design. For further reading on the economics of animal disease and its control see Bennett (2003), Bennett & Ijpelaar (2005), Bennett & Marshall (1999) and McInerney (1996). Two useful publications on trade policy and the sanitary and phytosanitary rules are by Josling, Roberts & Orden (2004) and Anderson, McRae & Wilson (2001).

A similar situation exists in relation to the smaller but growing number of publications on animal welfare. Relatively little has been written about the design and assessment of policies for the improvement of animal welfare, although Bennett (1995, 1997a,b) presents some economic principles and broad policy options for addressing animal welfare issues whilst McInerney (2004) provides a useful review of economics and policy applied to animal welfare. The declaration of the Animal Health and Welfare Strategy for Great Britain (Defra et al, 2004) is, of course, relevant to both policy areas.

Animal health and welfare policy falls within the domain of “public sector economics” (e.g. see Stiglitz 2000). Even more relevant is the growing literature on regulation. Useful references include Viscusi, Vernon & Harrington 2000), giving a USA perspective, and Baldwin & Cave (1999) and Ogus (1994) relating more closely to British conditions. These books are concerned mainly with the post-privatization regulation of public utilities, such as those for telecommunications, gas, electricity and water. However, the theory, which combines economics with politics and legal matters, relates to all forms of social control or influence. Many papers on regulation are published in journals such as *Economic Inquiry*, the *Journal of Institutional and Theoretical Economics* and the *Journal of Regulatory Economics*.

In accordance with National Policy, Defra has developed a Farm Regulation and Charging Strategy, described in the report “Partners for Success: A farm regulation and charging strategy” (Defra 2005). Many of the regulations considered relate to animal health and welfare issues such as animal by-products legislation, bovine TB pre-movement testing, broiler welfare regulations and risk-sharing mechanisms for exotic and endemic diseases.

The report is accompanied by a large number of supporting documents, including six on the “economic analysis of the cumulative impact of future regulation.” Although these papers emphasise the importance of an economic input, to assess potential causes of market failure and their mitigation for policy design and assessment, no attempt is made to propose a planning framework or to suggest criteria for policy assessment. The present study attempts to fill these gaps.

3. Methodology

The programme of research was conducted in a series of stages comprising of (a) a literature review of policy mechanisms, both within and outside of the area of animal health and welfare (b) a workshop in which policy mechanisms were assessed (c) the development of a decision-support framework for the consideration of government interventions in animal health and welfare (d) case studies of animal health and welfare problems and the means by which policy mechanisms for these might be developed and appraised.

The literature review informed the project of rationales for intervention, policy mechanisms and their appraisal. These rationales for intervention, policy mechanisms appropriate for animal health and welfare and the criteria by which these mechanisms should be appraised were then developed through the workshop, held at The University of Reading during November 2005. Papers and attendees are given in Appendix 1.

Following the workshop a framework for developing and appraising animal health and welfare policy was drafted. This framework provided a structure for the development of policy and a clear indication of those points at which economic analysis should contribute. The framework was further refined through the development of six case studies of animal health and welfare issues.

Set out below is the background to the development of the framework. Subsequent chapters provide details on specific elements of this framework and on the application of the framework to the case studies.

Developing the framework

In developing the framework for policy development and appraisal a decision making approach was taken. The *decision making process* as envisaged for those involved in animal health and welfare policy formulation and assessment is shown in Figure 3.1 (p.10). This is adapted from models used for the planning of public sector projects (e.g. within Defra, the ROAME+F assessment), and simplified below.

[Problem recognition] → [Information search and assessment] → [Decision] → [Post-decision evaluation]

Within the description of the decision making process (see paragraphs below) those elements within the 'information search and evaluation' stage are expanded to provide a more complete picture. In particular an assessment has been made of where information should be drawn from economic, as well as veterinary, analysis of data.

The decision making process

Stage 1 The first stage is that of 'problem recognition', the identification of the need for decisions to be made. This may be as simple as a new emerging disease being reported for the first time by veterinarians and therefore requiring attention or it may be more complicated and involve a political or media shift and a consequent re-evaluation of the status-quo.

Stage 2 The second stage involves a full specification of the decision problem in technical terms – such as likely spread and incidence, impacts on the animals concerned (e.g. mortality, effects on welfare), impacts on production (e.g. litres of milk lost, effects on fertility etc.) and it includes specification of possible disease control methods (e.g. treatment, vaccination, movement controls).

This stage also requires the assessment of the technical specification in social and economic terms. This may include impacts on markets and effects on industries within the food supply chain and external to it. It will include the identification of the actors (sectors, bodies and government departments) on whom the 'problem' impacts and an assessment of how close those

actors are to the problem itself. It will include a description of where the costs of the disease lie and identification of the area and causes for market failure from the following list:

- i) Non-competitive market structure (e.g. monopoly power).
- ii) Externalities, non-market impacts on other people.
- iii) Public goods: non-rival and non-excludable.
- iv) Incomplete markets: high transaction costs or weak property rights.
- v) Lack or asymmetry of information

This assessment should further identify whether or not government intervention is appropriate or necessary.

Stage 3 Following this, the third stage is consideration of the desired objective(s) of policy – for example, to eradicate disease, to slow the spread of disease, to protect human health or to safeguard exports. At this stage, economic input is required to question the rationale of these objectives and of government interventions and to ask whether policy objectives fit with the justification for intervention (see Chapter 5 and Table 1 for a list of the main reasons for government policy intervention generally and as applied to animal health and welfare). Economic analysis should also help to identify ‘real’ (opportunity) costs and benefits of responding to the problem perceived. Qualitative HACCP analysis may be appropriate at this stage.

Stage 4 The fourth stage in the decision making process involves identification of possible alternative courses of action (i.e. broad strategy options). These will largely depend on technical aspects of the animal health and welfare problem (e.g. what are the preventative measures available, such as vaccines; what treatment measures are available, such as effective medicines; what species and production systems are affected, what disease vectors are involved etc.). Information on likely economic impacts of alternative courses of action and the economic arguments for using various different policy instruments is also needed to formulate alternative policies for further consideration (see Chapters 5 and 6 and Table 2 for a description of the main policy instruments as applied to animal health and welfare).

Stage 5 This stage involves making a short list of most likely policies with a detailed formulation of alternative courses of action. This will include detailed specification of policy instruments and how they will be applied in practice. Both qualitative (e.g. Table 4) and quantitative economic information may be used at this stage. Also, at this stage it should be possible to assess whether more in-depth appraisal of particular policies is necessary.

Stage 6 This stage involves more in-depth policy appraisal may involve systems and epidemiologic disease modelling and economic modelling, the latter ranging from simple cost-benefit models to market and industry effects models through to general equilibrium models where impacts on the whole economy are estimated. The modelling and other analyses will need to include consideration of risk and uncertainty. Throughout the policy identification, specification and appraisal stages, wider expert and stakeholder consultation will be involved.

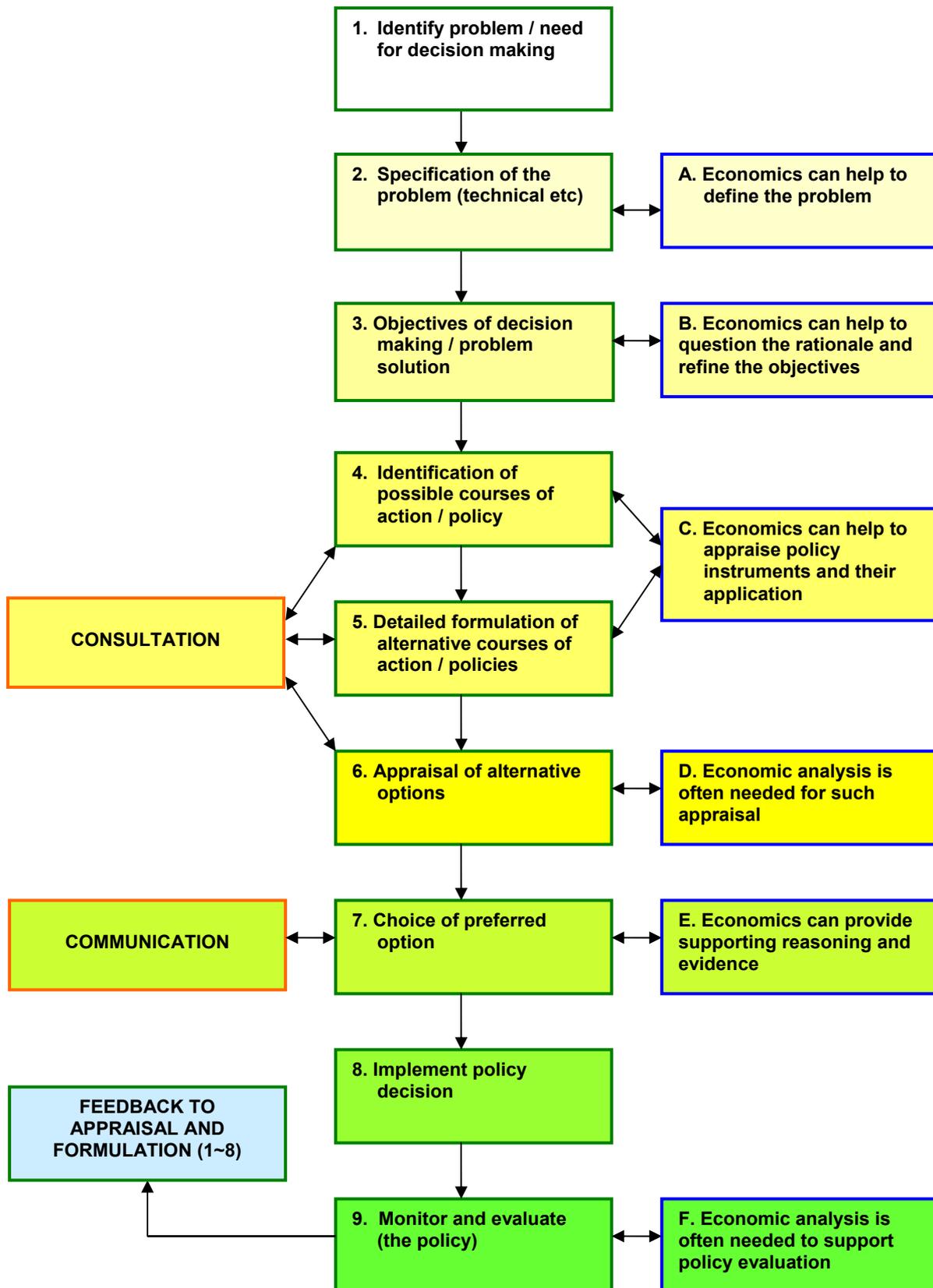
Stage 7 Following such analyses and considerations, a decision must be made concerning choice of preferred strategy according to multi-criteria including technical, economic and social, and political factors (see Chapter 8). At this critical stage, communication of preferred policy option with stakeholders can be aided by economic reasoning and evidence.

Stage 8 The policy decision then needs to be implemented.

Stage 9 The progress of a policy should be monitored and evaluated post implementation. At this stage further economic assessment may be needed.

Depending on the success or otherwise of the policy decision, the strategy may need to be re-formulated, thus going back to *any* of the points in the decision making process.

Fig. 3.1 The decision making process in animal health and welfare policy

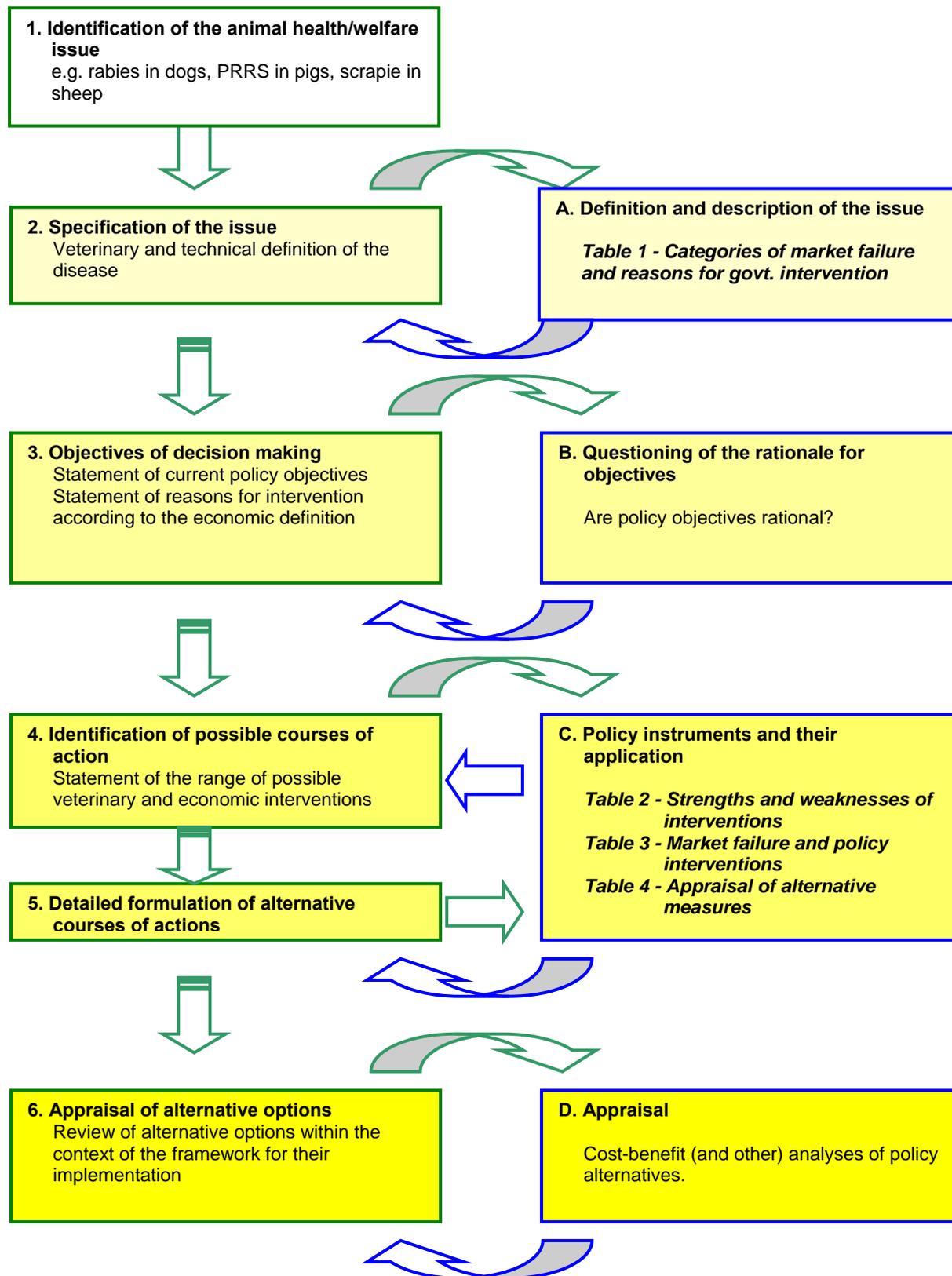


The Framework

From this decision making process a framework for developing and appraising animal health and welfare policy was drawn up, as shown in Figure 3.2 (p.12). This takes the first six stages of the decision making process and builds onto them the necessary considerations to be made and analyses to be undertaken. It was not within the scope of this study to undertake in-depth analyses of particular policies. Stages 7 through to 9 have been omitted, since the analyses of our case studies relate to ex-ante appraisal of policy and do not include these stages (which generally require substantial data and resources to undertake).

The right hand set of boxes lists inputs into the process where economics and economists can often make a very substantial contribution.

Fig. 3.2 A framework for the decision making process in animal health and welfare policy



4. Reasons for government intervention in animal health and welfare

The description of the animal health and welfare problem from an economics perspective is part of the second stage of the framework, which brings 'economic thinking' into the process of policy development simultaneously with 'veterinary thinking' and 'political thinking'. This can be critical if subsequent stages in the decision making process are to be successful. For example, the economic rationale for government objectives often can be effectively questioned (stage 3) and interventions (stage 4) can generally be more easily and accurately determined within a framework of economic analysis.

Definition of the animal health and welfare problem within an economic framework leads on to consideration of whether government intervention might be necessary or not and the rationales for intervention. Understanding and questioning the rationales for government intervention in animal health and welfare is part of the third stage of the framework.

Economics contributes to a range of rationales for government intervention based on generic principles rather than sector-specific details and these are listed in Table 1 (p.14). Four of the six main headings given in this table (imperfect competition, externalities, information asymmetries and public goods) relate to reasons for market failure. These rationales tell us *why* the market on its own is failing to deliver what society wants and pose the questions of whether and how government might intervene to improve the functioning of markets or to mitigate or counter undesirable indirect effects of markets. As such, these rationales provide an analytical, evidence-based platform from which to identify possible courses of action. However, two of the rationales are not related to market failure as such but to distributional equity and to social goals.

Each of the rationales for government intervention is considered in turn below.

Imperfect competition (monopolies and anti-competitive behaviour)

Competitive markets with many buyers and sellers, good information about products and prices, and freedom of entry and exit from the industry or market have recognised benefits in terms of economic efficiency. Prices act as signals to resource use and if these prices are distorted in some way or if there are barriers to entry for producers to enter a market then resources will be less well used. Competition helps to achieve low cost production at the technical optimum (in the long run) with lower prices to consumers than in monopolistic markets. Monopoly is a situation where a single seller (pure monopoly) or group of sellers acts as a price setter. Under monopoly, prices tend to be higher and quantities lower thus resulting in less benefit to consumers (and society generally) than might be achieved under more competitive conditions. Anti-competitive behaviour involves a variety of practices by companies seeking to exert control over a market, for example control over raw materials needed for production and short-run price cutting designed to force other companies out of the market or discourage those from entering.

Table 1. Rationales for government intervention

Rationale	Main aims of regulation	General example	Animal health & welfare
i. Imperfect competition			
Monopolies and natural monopolies	Counter tendency to raise prices and lower output. Harness benefits of scale economies. Identify areas genuinely monopolistic	Public utilities	Professional veterinary practice in some developing countries Drug manufacture
Anti-competitive behaviour	Prevent anti-competitive behaviour.	Abuse of dominant position	Possibly some drug & vaccine producers
ii. Externalities			
Externalities (costs)	Compel producer or consumer to bear full costs of production rather than pass on to third parties or society.	Pollution	Disease spread Animal suffering
iii. Information asymmetries			
Information inadequacies	Inform consumers to allow market to operate.	Pharmaceuticals, Food and drinks labelling	Lack/asymmetry of information on disease risks
iv. Public goods			
Public goods and moral hazard	Share costs where benefits of activity are shared but free-rider problems exist.	Defence & security services. Health services	Biosecurity. Non-compliance. Welfare, wildlife environment.
v. Distributional Equity			
Distribution justice & social policy	Distribute according to public interest. Prevent undesirable behaviour or results.	Victim protection Discrimination Compensation	Disease outbreaks and compensation
Windfall profits	Transfer benefits of windfalls from firms to consumers and taxpayers.	Firm discovers cheap source of supply	Holder of patent on critical drug in an emergency.
Scarcity & rationing	Public interest allocation of scarce commodities.	Petrol shortage	Disease control services in an emergency
Unequal bargaining power	Protect vulnerable interests where market fails to do so.	Health & safety at work	Vets. & farmers & drug companies
vi Social goals			
Rationalization & coordination	Secure efficient production where transaction costs prevent market from obtaining network gains or efficiencies of scale. Standardisation.	Disparate production in agriculture & fisheries	Necessary for national disease control/eradication
Continuity and availability of service	Ensure socially desired (or protect minimal) level of "essential" service.	Transport services to remote regions	Provision of emergency veterinary services
Non market objectives	Future generations. Altruistic objectives	Environment	Animal welfare

Externalities

Externalities occur when economic decisions create costs or benefits for people other than the decision maker. Thus, they are costs or benefits which are external to a particular production process or *to the markets in which inputs and outputs are exchanged*. Environmental pollution is a much-used example of a negative externality that results (unintended) from much economic activity such as manufacturing and, in some cases, agricultural production. Some of the effects of diffuse pollution from farming may be conceived as a negative externality, since they affect the health and the enjoyment of the countryside of people not benefiting, financially or otherwise, from that agricultural practice. Similarly, farming practice may improve the biodiversity of the farmed environment and this may be deemed as a positive externality. The challenge is how to best deal with such externalities, for example whether they can be internalised into the market in some way such as the use of pollution taxes.

Externalities associated with animal health include the spread of disease from one farm to another with the associated mortality and morbidity costs and disease control costs. Disease spread between farms and between species may be seen as a 'greater degree' of externality whilst disease spread from animal to human hosts (zoonoses) may be seen as a particularly important negative externality of livestock keeping.

Clearly animal health has significant elements of an externality. However, poor animal health may also have a significant impact upon the farmer who doesn't undertake appropriate actions to prevent and treat disease, and despite the animal health externalities the private goods⁵ accruing from positive animal health remain significant.

A further externality of disease spread which should be noted is that which involves wildlife, which may be affected by the health status and control of disease at farm level.

The spread of disease mirrors the externality of diffuse pollution, with the critical distinction that disease spread can increase or decrease in magnitude, whereas a 'unit' of pollution may become dispersed, or become neutralised, but it will generally not increase in magnitude. Similarly, discussion of the transmission of diseases between wildlife and domestic hosts reflects that between intensive agriculturalists and environmentalists; in most cases the environmental or wildlife cost or benefit has not been translated into a financial or tangible measure of sufficient value and of a type which can be traded within the markets which constrain and influence the activity. They remain external to the market.

Externalities associated with animal welfare include, most particularly, the concerns of people about poor animal welfare that results from animal production and the consumption (by others) of animal goods or services. The most important issue for policy here, as implied earlier, is the extent to which consumers should be given the option of paying more for products associated with higher animal welfare and the extent to which higher welfare should be imposed with no choice, in response to public preferences or (possibly if sometimes less desirably) in response to minority or media lobbying.

⁵ A private good is a cost or benefit accruing from an activity only to the person or firm carrying on the activity; there are many associated with animal health and welfare. Healthy animals may convert feed to meat more efficiently. High health status animals may gain access to a market, or indeed preferential market share for a farmer. A consumer's satisfaction may be increased by knowingly purchasing high-welfare products. Where externalities and public goods can be transformed into private goods then their production and control may be more readily achieved through the market.

Lack of information and information asymmetries

Information is a critical component for the efficient working of markets, indeed, the economic benefits of a competitive market can only be realised with good information about products and prices (the economist's model of perfect competition includes perfect information). Information as it relates to animal health and welfare encapsulates the understanding of diseases and husbandry, epidemiological data, welfare, the end-markets for agricultural products and the perceptions of animal welfare by consumers. A lack of information prevents markets from working efficiently.

Information 'asymmetries' may possibly be exploited by one participant in a joint activity, or contractual agreement, who has more information than another. The relatively uninformed party is often referred to as 'the principal', who employs a more informed party known as 'the agent'. Examples of principal and agent include policyholder and insurance company, employer and employee, and livestock owner and veterinarian.

Possible resultant behavioural outcomes are well illustrated in the case of insurance. Adverse selection (*ex ante* opportunism) occurs when only those individuals most at risk choose to take out a policy. Moral hazard (*ex post* opportunism) occurs when those that are covered by insurance become careless regarding the risks against which they are insured.

Public goods

A public good is a product or resource which benefits 'virtually everyone' in society (i.e. is non-excludable) and which is non-rival (an individual's consumption does not reduce the total available) and hence non-exhaustible. National defence is a much-used example of a public good since it is not possible to exclude anyone from benefiting from it and one person's benefit or use of the good does not detract from any other person's. Because of this, such goods are very difficult to charge for and so are unlikely to be provided by the market. Other goods and services display public good characteristics (although they may not be 'pure' public goods in the way that national defence is). Public health schemes, road building and maintenance, and education are activities with outputs which fall into this category (since there may be partial markets for these). A clear, untolled road is a public good, since one person's use of the road will not impact upon another's, whilst a busy road introduces rivalry in use since one person's use of the road will restrict its use by others.

The notion of public goods is important in considering policy responses to animal diseases, and in particular in considering zoonoses and animal welfare. The control of zoonoses may be seen as a public good: the benefit accrued to each individual does not reduce the total benefit available to the whole population (it is non-rival), and nobody can be prevented from enjoying the benefits (whether they know it or not) of that control (non-exclusive). Control of diseases considered likely to become zoonoses, is also a public good.

The extent to which the control of non-zoonoses is a public good is less clear. The animal welfare implications of disease (zoonoses and non-zoonoses) have public good aspects, as well as those associated with externalities. High standards of animal welfare are non-rival and non-exclusive and are therefore by definition public goods. However, the importance of it as a public good depends on the extent to which the population is concerned about animal welfare (see McInerney, 2004).

Where a particular public good is provided by government there may be the assumption that this is government's responsibility and that government will, and should, continue to provide it. In the case of disease control, because government has intervened in a number of areas (for example, where the negative externality or public good arguments for intervention may have been strong) there has been an

assumption on the part of many in the livestock and veterinary sectors that government should intervene in all animal health and welfare – even where there may not be a strong case for government to do so – which arguably has hampered industry and animal keepers initiatives, including market-based ones to address animal disease problems.

There are two sub-categories of public good that are sometimes referred to. These are:

(i) Merit goods. A merit good is a benefit arising from an activity which is believed to be greater for society as a whole than is reflected in consumer preferences. That is, individuals may not choose this benefit, but a collective view is that they should have it (e.g. education). For example, standards of animal welfare which are higher than those reflected in consumer choice might arguably be deemed to be a merit good.

(ii) Toll goods. A toll good is one whose benefits are excludable but largely non-rival (e.g. a toll on an uncongested road). Many of the benefits of animal disease control (e.g. border control) fall into this category; the financial benefits may only be derived by keepers of domestic animals (i.e. non-keepers are excluded), but within this group the benefits derived by one member do not effect the benefits derived by another (i.e. the benefits are non-rival). The application of levies and charges to animal keepers by government for animal health is an example of a policy response to such toll goods.

Distributional equity refers to the fairness of the distribution of resources or costs and benefits within society, arising from any source, including markets and government intervention. There are many interpretations of what 'fairness' means in practice, including equality in opportunity, equality in outcome, distribution according to need and that expectations should not be disappointed. There is broad scope for these interpretations to conflict. However, the concept of fairness is an important one not only upon ethical grounds but also on the grounds of public and political acceptability and provides a very real rationale for government intervention. In the area of animal health and welfare, cost-sharing initiatives within the Animal Health and Welfare Strategy of Great Britain are partially driven by distributional equity considerations (i.e. determining a fair share of costs of disease control along the food supply chain and with government/taxpayers).

Social goals are government objectives relating to, for example, concern for particular sets of individuals, or the economic, social or environmental quality of particular areas or regions. Measures to support such objectives may include the rationalisation and coordination of markets or, for example, the integration of measures to ensure the environmental, social or economic sustainability of activities. The outcome of social goals may include public goods or the more distinct category of merit goods, that is, goods or services whose consumption is believed to confer benefits on society as a whole greater than reflected by consumers' preferences. Social goals might include aid to farmers (e.g. for disease control) on the grounds that society benefits from having a thriving farming community.

The advantages of considering the reasons for (and against) government intervention according to these criteria are that they describe animal health and welfare problems as they relate to individual and societal values and they provide a link to the types of policy solutions that may be appropriate (see Chapter 7).

5. Categories of government intervention

The identification of possible courses of action is the fourth stage in the framework, and requires the identification of alternative veterinary or other husbandry measures and policy instruments for their implementation.

Where markets fail to deliver the goods or services needed to achieve socially acceptable levels of animal health and welfare (for reasons identified within stage three) there are a variety of interventions which are available. Table 2 (p.23) outlines the main categories of policy instruments. For each category a general example is given and then a more specific example relating to animal health and welfare, and the main strengths and weaknesses of each of these instruments are listed. This schedule of interventions is intended to give an overview of the means by which animal health and welfare outcomes may be achieved. The relationship between these interventions and the reasons for market failure are examined in Chapter 6. Listed below are some more detailed descriptions of each of the interventions. It is important to note that these interventions are not mutually exclusive and that normally a range of interventions would be applied within a single implementation framework. This is addressed in Chapter 7.

1. **Command and control:** Whereby decisions upon the management of animal health and welfare are taken by the public authorities and statutory instruments are used to enforce the rules of behaviour. Within the scope of the regulations, there is no scope for private individual decision making.

This category includes animal movement controls and border controls, interventions which are highly relevant to the control of animal diseases and in particular to zoonoses. Compulsory vaccination is a form of command and control (although vaccination may also be promoted through self-regulation).

Command and control also includes *technical specifications*, where these are set by government. Technical specifications may be further subdivided into *product standards*, which define the observable health and welfare qualities of the product (live animal, meat, milk or eggs produced) and *process standards*, which address the way in which husbandry is managed (cage sizes, cleanliness, protection of health of animals etc). *Performance standards*, which address the actual (veterinary) health and welfare of animals, may be implemented at 'critical control points' such as abattoirs and markets.

2. **Self-regulation:** Whereby the government lays down general objectives, and entrusts the task of devising and enforcing detailed rules to a body representing those in the sector. This approach may be based on voluntary initiatives, with little or no outside intervention. However, incentives may be offered through assisted funding, and the self-regulation is monitored to some degree and in some cases enforced by government.

This category may include certain farm-assurance schemes, where these set defined animal health and welfare objectives based upon government standards, or herd health schemes. Assurance schemes are private initiatives which operate throughout the agricultural industries to provide monitoring and assurance that product and process standards are met. Performance standards, the actual welfare of animals, may also be monitored through on-farm inspections. Assurance schemes normally arise from market pressures (e.g. Assured British Meat, Quality Meat Scotland, Farm Assured Welsh Livestock) and provide evidence of due diligence.

Within self-regulation, the technical specifications must equal or exceed those set by government. The majority of assurance schemes do not go beyond the requirements for animal health and welfare as laid out in the Codes of Recommendations for the Welfare of Animals. However, higher

tier schemes such as RSPCA Freedom Foods do try to address this and give consumers assurance as regards higher degrees of animal welfare. There are also examples of the successful promotion of markets for specific animal health schemes. In Scotland, government funding and support has been a catalyst for the development of two competing schemes; the Premium Cattle Health Scheme which is administered by SAC Veterinary Services and Hi-Health, which is administered by Biobest Ltd and Orkney Livestock Association. They address a range of diseases of cattle including BVD, IBR, Johnes Disease and Leptospirosis and include disease screening, health planning and biosecurity as conditions of membership. The schemes operate across Scotland and the approach is now being adopted elsewhere in the UK.

3. **Incentives & taxes:** Incentives include both rewards and penalties, but should be based upon product or process standards which can be observed and measured by an external body. Monitoring is essential to limit opportunities for fraud.

Incentives relating to animal health and welfare may include, for example, subsidies for herd health planning and cross-compliance measures.

4. **Promoting private markets:** A number of alternative approaches are available, including the following:
 - a. **Competition laws:** to promote competitive market conditions for key goods and services, and limit or prevent market distortions.
 - b. **Franchising and licensing:** to authorise a private individual or agency to produce a given good or service. A franchise generally allows control of a significant part of the national market, and is allocated by competitive bidding. Licenses are issued at many levels and in some cases permit production of a damaging output such as pollution. However, the allocation of licenses, or permits, to reduce animal welfare is unlikely to be acceptable to the general public.
 - c. **Contracting:** has similarities with franchising, but whereas the latter usually offers the opportunity of increased market income, the former simply involves delivery of a service for a pre-agreed payment. For example, the control of a particular disease or aspect of animal welfare might possibly be contracted out to a private veterinary agency.
 - d. **Tradable permits:** are licences, often to create damage, such as pollution with the additional provision that they may be bought and sold (See Box 1).

All of these measures for promoting private markets appear to have limited direct relevance to the delivery of animal health and welfare policy.

5. **Disclosure and other measures to improve information flows:** Disclosure is the mandatory reporting of, for example, disease incidence. Statutory Reporting of disease is a commonly used intervention within animal health and welfare. More generally disclosure relates to the provision of information and may be linked with research, training and the dissemination of knowledge. Governments may have a role in promoting all these activities.

The spread of information on improved methods of husbandry and bio-security should result in greater disease control and better animal welfare. Exhortation, or the persuasion and leading of livestock producers and others into changing their behaviour, is the route by which many stand-alone information and education campaigns may be implemented. Whilst conventional thinking suggests this methodology will achieve minimal or token success, the analysis of previous

information campaigns within livestock farming indicate that such a route may be highly successful, with the caveat that reaching and influencing a sufficiently wide target audience may be difficult. Critical within this consideration is that the uptake of information is not primarily dependent upon rational financial decision making, but relies heavily upon peer pressure, personal preferences and trust/mistrust of the sources of information (e.g. Garforth *et al*, 2004; Rehman *et al*, 2003; Moss & Webster, 2004).

Information provided to consumers on methods of livestock production, by labelling, allows adjustment of purchases in the light of disease risks and animal welfare. Improved dissemination of information also reduces problems of information asymmetries between farmers, veterinarians and monitoring and enforcement agencies.

6. **Direct action:** applies where government or its agents accept full responsibility for the delivery of a service. This would apply, for example, to actions of the State Veterinary Service and to many areas of border control. Direct action is likely to be of particular importance in situations where public health or wider economic impacts (i.e. valuable public goods) are at stake. However, it may also be in place for purely historical reasons and as such may prevent the establishment of market-based alternatives.
7. **Rights & liabilities (laws):** This form of government policy relies on the application of existing laws (of Tort) relating to basic human rights. A similar approach may be adopted in relation to basic limits on cruelty to animals. Government, having established the legal framework, may leave its enforcement to legal actions taken by non-government bodies (e.g. RSPCA in the case of companion animal welfare) or members of the public.
8. **Public compensation/insurance:** Where compensation is paid or insurance provided for disease losses. This may be, for example, where disclosure (of disease) is encouraged through a financial incentive or, preferably, through the removal of financial disincentives. This would include compensation for animals slaughtered. Accurate valuation is important, to avoid over-generous compensation rates, which result in excessive cost and provide an incentive to have animals declared as infected or in dangerous contact. This problem contributed to the huge economic costs of the FMD outbreak in 2001 (Comptroller and Auditor General 2002) and Defra has since moved to a tabulation approach to compensation, based on market prices, for a number of cattle diseases (bTB, Brucellosis, BSE and Enzootic Bovine Leukosis). There are three main problems associated with the provision of insurance for producers.
 1. “Adverse selection”, whereby, if the scheme is voluntary, only those most at risk will participate. Thus average premiums have to be higher than would be the case if all producers participated.
 2. “Moral hazard”, in that if comprehensively insured, a producer has less incentive to maintain adequate bio-security and other disease-risk precautions.
 3. Uncertainty and covariant risk. Disease outbreaks have features in common with disasters such as floods or earthquakes in that large numbers of individual premises are involved, leading to a large aggregate cost, while records are sparse, making prediction of incidence and scale difficult. This is the main issue limiting the availability of private insurance cover against loss of animals due to disease. In contrast, life, household and motor car insurance are much easier to plan and administer since losses occur in a steady stream and extensive records are available.

Similar problems arise when assured compensation payments are made from public funds, although adverse selection is avoided where participation is compulsory. A case can be made for requiring producers to pay an annual premium or levy, as a contribution to a compulsory slaughter compensation fund. Furthermore, there may be scope for a government agency to adjust levy rates according to farm-level bio-security standards, in short to practice risk discrimination. Monitoring of bio-security standards may already be in place for disease control reasons. However, the problems of determining appropriate levels of insurance on the basis of predicted risks and costs of future outbreaks is just as great as it would be for private insurers.

9. **Institutional arrangements:** Organisations, systems and structures including government agencies, non-departmental public bodies, local authorities and such, that may be employed to implement some of the instruments discussed above.

10. **Novel policy instruments:** As part of this project the team were tasked with the consideration of novel policy instruments with which animal health and welfare could be addressed. The assessment of policy instruments relied on the formulation of the policy development framework and it was therefore not possible to properly appraise novel policy instruments. However, as examples of relatively novel policy instrument applied to animal health and welfare, Box 1 provides a consideration of the application of **Tradable Permits**, and Box 2 provides consideration of **Bidding for Contracts**. In addition, following increased levels of interest in responsibility and cost-sharing between industry and government, Box 3 examines the principles behind **Responsibility and Cost Sharing** for the control of animal health and welfare.

Box 1. TRADABLE PERMITS

An alternative technique for harnessing private markets is the use of tradable permits to engage in any activity that produces external costs that are deemed to require control, such as discharging pollutants into a watercourse, or producing milk surplus to national quota. Such a system has been applied, for example, to the control of carbon dioxide within the EU Emissions Trading Scheme. Consideration is now given to the possibility of using this method for the control of damage to animal welfare, or even for the control of a disease such as mastitis or helminthosis. The system is first described for existing uses of tradable permits for discharge of pollutants.

To establish such a system the public agency issues a given number of permits, to produce a specified quantity of the "external damage." For example this may be a permit to discharge a given quantity of pollutant into a watercourse. The initial allocation may be based on the current levels of productive activity among individuals or on the basis of a public auction. After the initial allocation has been made, permits may be traded. This allows producers who succeed in reducing their levels of pollutant discharge, to sell their excess allowances to other producers, who wish to expand.

There are some advantages claimed for the use of tradable permits. First, if the market works effectively, the excess pollution is produced by those most able to pay, namely the most efficient and profitable businesses, in financial terms. Hence the additional value added per unit of pollution is maximised. Once the initial allocations are made, trade in permits can take place with no further intervention, so managers are free to decide on whether or how to reduce emissions, while public sector costs of regulation are minimal.

Similar methods of implementation and advantages apply in the case of tradable quotas for milk production. They might equally apply if a system of tradable permits to extend the period of sow confinement after farrowing, or to increase the somatic cell count for mastitis above the recommended level. However, the introduction of tradable permits involves several problems that are likely to be particularly severe in the cases of animal welfare and animal health provision.

- The system is unworkable in situations where an absolute limit is set on the level of "external damage", such as animal discomfort or disease risk that may be generated by the individual producer.
- Even where there may be some flexibility regarding the level of external damage that may be generated by the individual producer, difficulties may arise in establishing an appropriate scale of measurement of animal welfare and disease risk.
- Enforcement would be needed to ensure that no individual producer exceeds the limits on external damage, set by his/her holding of tradable permits. This would necessitate funding for the inspectorate and a system of legal sanctions for non-compliance.
- The system of tradable permits fails to provide for compensation of other people affected by the external damage, for instance those disturbed by the knowledge of increased animal discomfort or greater risk of disease spread. Thus tradable permits could be seen as licenses to harm animals or spread disease. As such they may prove unacceptable to the general public or the animal health and welfare lobbies, or indeed to many farmers and pet owners.
- The market in tradable permits may take time to become established, thus causing a time lag. Furthermore **once established the system is rather inflexible and not readily adjustable in the light of technical, environmental or economic changes**. Once tradable permits have been allocated and have acquired a market value, these conditions (e.g. the specified quantities of external damage) cannot readily be changed.
- Uncertainties and lack of information may limit the number of potential buyers of permits so a competitive market fails to develop. If increased confinement of animals or relaxation of disease control prove profitable, a few large producers might accumulate most of the permits. The difficulty and cost of acquiring permits might then act as a barrier to new entrants to the industry.

The first four of these problems in particular make it very unlikely that a system of tradable permits could be established to control animal health and welfare provision, whilst the fifth presents significant limitations on the use of tradable permits in addressing issues as complex as animal health and welfare.

Box 2. BIDDING FOR CONTRACTS

Environmental conservation may be encouraged by offering financial incentives to agricultural producers. However, rather than awarding a standard per-hectare payment to all producers, market forces may be applied by limiting the total number of contracts for which applications are voluntary but subject to competitive bidding. The Conservation Reserve Program (CRP) of the United States Department of Agriculture is such a scheme.

Under this scheme annual 'rental' payments and cost-share assistance are offered to producers to make long-term investments in converting highly erodible cropland and other environmentally sensitive areas to vegetative cover. During designated sign-up periods, farmers can apply for enrolment or for continuation of an existing contract, under a competitive bidding system. Applications are ranked according to an Environmental Benefits Index (EBI). The index is based on the likely improvements in wildlife habitat, air and water quality, on-farm reduction of erosion and the likely duration of benefits and costs. The cost-share is set at a maximum of 50 percent of the total costs of establishing approved practices. Maximum rental rates are determined before the sign-up period and are based on the relative productivity of soils in that region and the average dry-land cash rent or its equivalent. Producers may offer to enrol their land for less than the maximum rental rate and thereby increase the likelihood that their bids will be accepted.

In principal, it might be possible to adopt a similar approach to promote improvements in animal welfare, for instance by increasing the space available per animal or per bird, or in the protection of animal health, for instance by improving on-farm bio-security. Incentive payments would have to be offered on a per-animal or per-bird "headage" basis, unlike the per-hectare rental payments for environmental conservation. A limited number of contracts may be offered, by Defra at regular intervals, to provide assistance with the necessary investment and an annual headage payment on condition that the producer adopts a system providing more space (or greater bio-security) for the livestock.

This policy alone would not be sufficient to ensure that the basic minimum accepted standards of animal health and welfare are provided, by all producers. There would remain a need for legal enforcement to ensure that these conditions are met. Contractual support would then be offered for on-farm improvements in the standards of animal welfare and health care.

For the bidding system to work, applications would have to be ranked according to an Animal Welfare Benefits Index (or a Bio-security Benefits Index). The index would be based on the likely improvements in animal health and/or welfare. During designated sign-up periods, livestock producers would apply for enrolment, or for continuation of an existing contract, under a competitive bidding system. Producers who offer to enrol their livestock enterprise for less than the maximum headage payment would thereby increase the likelihood that their bids will be accepted.

This approach, like the use of tradable permits, is a means of harnessing market forces to improve the efficiency of provision of desired environmental or animal health and welfare, goals. However, while producers pay for permits to cause environmental or other damage, contracts involve payments to producers who reduce such damage. Permits are sold to the highest bidder, while contracts are awarded to the lowest cost provider of welfare or health services. This approach is likely to be more acceptable to the general public than the use of permits to allow reductions in the levels of health and welfare provision. None the less, difficulties may arise in designing and applying such policies.

1. The use of public funds to support on-farm provision of improved animal welfare and/or health must be justified for the system to operate. It is not necessary for the support offered to cover all the costs. In the case of the CRP the maximum cost-share component is only 50 percent of the total costs of establishing approved practices. However, the basis of the contract is that the producer provides an additional service in exchange for financial support.
2. The system requires that bids can be ranked on an index of animal welfare or of animal health. This may be difficult given the multiple sets of conditions influencing animal welfare and health. Such an index, or scale, should be transparent and seen to be just and fair.
3. Monitoring and enforcement, at public expense, may be needed to ensure that producers comply with the terms of the contract. Problems of measurement of standards of health and welfare achieved would make monitoring difficult and costly.
4. The award of contracts may take time to develop, because of communication problems, and few producers may bid for contracts. The contracts may involve long-term investment in animal housing and equipment, so must apply over an extended period. However, regular re-contracting is desirable to ensure reasonably competitive conditions apply.

Despite these difficulties, a system of bidding for contracts may provide useful market incentives for cost-effective improvement in animal health and welfare.

Box 3. SHARING RESPONSIBILITIES AND COSTS OF ANIMAL HEALTH AND WELFARE

Government, livestock keepers and others along the food supply chain undertake actions to reduce the risks associated with disease and take measures to try to protect animal welfare. Key questions are, 'where do responsibilities for animal disease prevention and control lie?' and 'who should bear which costs?' Satisfactory answers to these questions should result in better disease risk management with lower costs of disease prevention and control over time and an equitable share of costs and benefits along the food supply chain.

Principles for cost sharing

Principles for cost sharing include those based on liability and the distribution of costs and benefits. A principle based on liability is the 'polluter-pays-principle', which has been widely applied to environmental pollution issues. In the case of animal health and welfare it would mean that those who create the risk or contribute by their activities to the magnitude of the impacts of disease and its control would pay accordingly. However, this is a very difficult principle to apply to animal disease in practice. For example, in the case of exotic disease, livestock farmers may argue that Government is liable for the introduction of disease since Government has taken responsibility for border protection. However, it could equally be argued that Government undertakes border protection because livestock farmers do not have the authority or the organisation to take on such a role and that this does not in itself constitute an acceptance of liability.

Similarly, for example, one livestock keeper may sell an animal to another livestock keeper without knowing that it is carrying a contagious disease affecting production. As a result, the animal dies but before doing so it infects all of the other animals on the farm. Where does the liability lie and how far does it stretch? Is it the seller, as the polluter, who should pay for all the adverse consequences resulting from the sale of the diseased animal or does the buyer have some responsibility for testing for disease or for isolating bought in animals before introducing them into the herd/flock? Would the seller be liable for the loss of the sold animal but not for the consequential loss to the whole herd/flock?

The issue of responsibilities may be so fraught with subjective arguments as to be impractical as a basis for decisions concerning cost sharing. Although the polluter-pays-principle is a widely accepted one and should not be ignored, it may not be easy, in an animal disease context, to obtain consensus on who the polluters are and what their liability is.

A principle based on the distribution of benefits and costs (winners and losers) would involve costs shared according to who gains and who loses from disease and disease control. This assumes that the winners and losers from disease and from disease control can be identified, that the benefits and costs involved can be estimated and that gainers from policy could compensate losers.

Distribution of benefits and costs of disease will depend on the precise nature of the disease incident. Thus, who gains and who loses and by how much will vary depending on the disease in question, the extent and rapidity of its spread, its impacts on livestock production and other industries along the food supply chain and external to it (e.g. rural businesses in the 2001 FMD outbreak in Great Britain), and upon the impacts of disease control measures. Thus for every disease incident the distribution of costs and benefits will be different.

Moreover, since costs and benefits may be shared along the food supply chain, and external to it, there is an issue as to who should be included in cost sharing. Should it be just government and livestock keepers or should the principle extend to others such as food manufacturers, food retailers or consumers? In reality, because of the market system, both costs and benefits of disease and its control will be, in part, distributed along the supply chain by means of market prices and product quantities. Generic rules for cost sharing based on costs and benefit are therefore difficult to specify.

Disease categories

Some general guides as to the likely distribution of costs and benefits of disease and its control may be possible and a number of disease problem categories may be defined, based upon the reasons for government intervention presented in Chapter 4. For example, in the context of exotic disease:

1. Non-zoonotic exotic disease with slow spread and relatively straightforward to control at farm level.

Farmers can control the disease, there is no risk to human health and so farmers benefit from control rather than society generally. For such a disease, the primary loss and benefits of control of the disease fall to the individual livestock keeper and to livestock keepers generally with some relatively minor, public benefit of disease control being the contribution to citizens in GB and consumers domestically of a 'healthy' cattle population. There may be a role for government in terms of border protection and again, some benefit to the livestock industry and GB of preventing entry of an exotic disease that trading partners may also wish to avoid. In this instance, there is a case for livestock keepers to pay for the economic losses and to pay for disease control more than for others along the food supply chain or for society generally and it could be argued that producers should pay a relatively large share of costs of the disease and its control compared to government (on behalf of taxpayers).

cont.

Box 3. (cont.) SHARING RESPONSIBILITIES AND COSTS OF ANIMAL HEALTH AND WELFARE (CONT.)**2. Non-zoonotic exotic disease with rapid spread, uncertain/difficult control at individual farm level, substantial impacts on production, no risk to human health although there are potentially serious negative externalities associated with animal welfare problems and a substantial threat to international trade (e.g. FMD).**

In this case, the losses from the disease are primarily felt by livestock farmers generally and the benefits of disease control would also largely accrue to livestock farmers but also with some benefit to the economy/country in terms of addressing animal welfare problems (public good) and safeguarding against potential trade restrictions which might damage the economy. Government is likely to take the responsibility for border protection, the cost of which could be included in cost share calculations. Farmers have a significant responsibility to control spread but much depends on the actions of others in this regard. Costs of the disease fall largely on livestock keepers but with implications along the food supply chain. In this case, it could be argued that the share of costs of the disease and its control might be at a lower level for producers, and that government (on behalf of taxpayers) might contribute a larger share than for 1. (above).

3. Zoonotic exotic disease with rapid spread, potentially difficult to control, substantial impacts on production and animal welfare, substantial threat to international trade (e.g. Avian Influenza).

This case has similar characteristics to that of 2. (above) with the added public health dimension. There are clear potential costs and benefits to both livestock keepers and those along the food supply chain, and to society generally (primarily in terms of human health, but also in terms of animal welfare and international trade). In this case, it could be argued that the share of costs of the disease and its control might be lower for producers than in 1. or 2. (above) and relatively higher for government (on behalf of taxpayers) than in 1. or 2. (above).

These categories and the associated ranges of cost sharing are merely indicative examples. Agreement on shares would need to be on the basis of information on current costs and by whom they are borne and a more in-depth examination of the share of benefits of disease control for each disease/disease category.

Incentives to good practice to improve health and welfare

There are a number of incentives to encourage good practice broadly characterised into 'carrots and sticks'.

- 1) Carrots –
 - (a) Incentive payments for good practice (biosecurity, hygiene etc.). These may be direct payments (e.g. per litre of milk), grants to implement measures (potential through EU rural development policies and agri-environment support), reductions in levy payments etc.
 - (b) Demonstrated improved profitability from undertaking good practice
- 2) Sticks –
 - (a) Taxation (e.g. through a levy) for not adopting good practice through levy (this may be difficult unless done on a very simple basis), cross-compliance, reduced compensation payments, lower product price (e.g. milk price).
 - (b) Denied membership of farm assurance or other marketing scheme with subsequent effects on market access and price
 - (c) Disease losses and their impact on profitability.

The implications of these incentives for cost sharing are:

1. No cost sharing agreement should entirely nullify farmer costs of disease because this removes the primary economic incentive to livestock keepers to avoid disease. In particular, great care must be taken in compensating farmers or others that perverse incentives are not created.
2. Compensation, if paid, should be linked to the individual actions of livestock keepers and reduced accordingly if good practice is not followed or if the livestock keeper has acted negligently (perhaps a case for not paying compensation at all) or not with due diligence.
3. If an animal health/disease control levy is used it needs to act as an incentive.
4. Incentives to industry to cost share, make levy payments etc. will be enhanced by the opportunity for those sharing the costs to be involved in the decision making process (which requires appropriate institutional structures and processes).

Table 2. Strengths and weaknesses of some types of government intervention

Strategy	General example	Animal health & welfare	Strengths	Weaknesses
1. Command & control	Health & safety at work	Animal movement control. Minimum space rules for pigs & poultry.	Force of law. Minimum standards set. Immediate. Transparent. Forceful.	Intervention in management. Incentive to meet, not exceed standard. Costly. Inflexible.
2. Self regulation	Insurance industry	Farm assurance schemes, veterinary profession, industry codes of practice.	High commitment. Low cost to govt. Flexible.	Self-serving. Monitoring and enforcement may be weak.
3. Incentives and taxes	Differential tax on leaded & unleaded petrol	Contingent payment of subsidies. Cross compliance. Pillar II monies for farm health plans. Carcase disposal.	Low regulator discretion. Low cost application. Economic pressure to behave acceptably.	Rules required. Predicting outcomes from incentives difficult. Inflexible.
4. Promoting private markets	Office of Fair Trading Airline industry. Telecommunications	Drug companies.	Economies of scale in use of general rules. Low level of intervention.	No expert agency to solve tech./commercial problems in the industry. Uncertainties and transaction costs.
a) Competition laws				
b) Franchising and licensing	Rail, television, radio.	Drug or vaccine manufacture?	Low cost (to public) of enforcement.	Evidential difficulties
c) Contracting	Local authority refuse services	Hire of private vets to provide public services.	Combines control with service provision.	Confusion of regulatory and service roles.
d) Tradable permits	Sulphur dioxide emissions (USA)	Milk quotas	Pollution by greatest wealth creator.	May require a directorate.
5. Disclosure	Mandatory disclosure in food/drink sector.	Reporting of OIE List A diseases Labelling	Low intervention.	Information users may make mistakes.
6. Direct action	State-supplied work premises	Control of epidemics. Border controls.	Can separate infrastructure from operation.	Fairness of subsidies may be contentious.
7. Rights & liabilities: Laws	Rules of tort law: right to light or clean water.	Prevention of cruelty to animals. Five Freedoms, sentient beings.	Self-help.	May not prevent events resulting from accidents +/- irrational behaviour.
8. Public compensation/ social insurance	Workplace safety schemes (USA, Canada, Japan, New Zealand)	Compensation for animals slaughtered for disease control or welfare reasons. Livestock disease insurance schemes.	Insurance provides economic incentives.	Incidence levels may be too low to allow risk discrimination.
9. Institutional arrangements	Departmental agencies, levy boards, local government.	State Veterinary Service, Meat Hygiene Service, Veterinary Laboratories Agency, Local Authorities.	Specialist function. Accountability.	Potential for narrow focus of responsibility.

6. The relationship between rationales and interventions

One suggestion, stemming from the workshop, was that a matrix should be prepared to emphasize which of the policy instruments listed in Table 2 (p.23), are best suited to dealing with alternative causes of market failure given in Table 1 (p.14). The aim of this exercise was to facilitate the search for appropriate policy instruments in relation to a particular cause of market failure associated with a given animal health and welfare problem. The resultant matrix is presented in Table 3 (p. 25).

The list of causes of market failure, or reasons for intervention, has been reduced to include only the headline rationales. However, it is assumed that the list still includes all the usually quoted causes of market failure.

The entries in the matrix may be interpreted as follows:

- ++ implies that the instrument is highly appropriate for overcoming the market failure
- + implies that the instrument may be used, possibly as a complementary measure
- implies that the instrument may increase the risks of market failure
- implies that the instrument may cause market failure
- ? implies indecision regarding the impact

A blank cell indicates that no impact, on the cause of market failure, could be identified for that particular instrument.

Combinations of symbols imply that both impacts are possible.

It should be recognised that the choice of these matrix entries was based on personal judgement, but that the entries were inserted, only after discussion and agreement between report authors.

The underlying logic may be illustrated by describing the choice of entries for the first two reasons for market failure, imperfect competition and externalities. In the presence of imperfect competition, command and control and enforced self-regulation are likely to be the most effective counter measures. However, it is possible that private, voluntary self-regulation, legislation to enforce greater market competition, existing laws protecting basic human rights, and institutional arrangements may reduce the impact of imperfect markets. Institutional arrangements may be introduced as a means of implementing command and control or enforced self-regulation. Franchising and licensing may have an adverse effect in establishing a statutory monopoly. Direct action by Government is likely to have an impact on markets but it is difficult to decide whether the impact is likely to be positive or negative (it would depend on the precise nature of the direct action).

External costs and benefits may be incorporated into resource allocation decisions by means of command and control, enforced self regulation or incentives and taxes. Un-enforced self regulation, use of tradable permits and quotas, direct action, public compensation and social insurance and institutional arrangements may contribute to the incorporation of externalities in decision-making possibly in support of command and control, enforced self-regulation or incentives and taxes. However, on their own these instruments are likely to be less effective.

This matrix was used in the analysis of the case studies to guide the choice of policy instruments in response to identified causes of market failure. It may be noted that for most cases of market-failure there are several appropriate regulatory instruments requiring further assessment. Furthermore, command and control and direct action are useful in many cases, but it should be remembered that these approaches are often inflexible and costly to implement.

Table 3. Rationales for intervention and possible policy instruments

		← Policy instruments →												
		Command and control	Self regulation		Incentives & taxes	Promoting private markets			Tradable permits & quotas	Information, training & disclosure	Direct action (inc. public ownership)	Rights & liabilities: Laws	Public compensation Social insurance	Institutional arrangements
			private	enforced		Competition laws	Franchising & licensing	Contracting						
← Rationales for intervention →	i. Imperfect competition (monopolies, anticompetitive behaviour etc.)	++	+	++		+	--				?	+		+
	ii. Externalities (costs)	++	+	++	++				+		+		++	+
	iii. Information imperfections and asymmetries	+	+	+	+	+				++	+	+		+
	iv. Public goods (inc. merit goods etc)	++	+	++	++		+	+		+	++	+	++	+ / ++
	v. Distributional equity (scarcity, windfall profits, unequal bargaining power etc.)	++	?	+	++	?		?		+	++	+	+	+ / ++
	vi. Social goals (rationalisation, coordination, continuity and availability of service, non market objectives etc.)	+/-	?	+	+	+	+	+		+	++	+		+ / ++

7. Policy Appraisal Criteria

Appraisal and evaluation of policy options requires that the criteria are established by which their appropriateness or success may be measured. Literature from the OECD (1995) regarding the control of environmental hazards focuses on efficiency and effectiveness as indices of success, whilst Gunningham & Sinclair (2005) in their review of instrument choice for controlling diffuse source pollution list efficiency (cost-effectiveness), effectiveness, equity and political acceptability. The UK Treasury 'Green Book' for policy/programme/project appraisal and evaluation in Central Government succinctly sums up the criteria by posing three fundamental questions concerning policy which are (i) are there better ways to achieve this objective and (ii) are there better uses for these resources and (iii) is it reasonable to assume that the benefits of intervention will exceed the costs?

Animal health and welfare policies affect a number of different groups of stakeholders, including Government agencies, livestock producers, owners of companion animals and veterinarians. The outcomes are subject to risk and uncertainty and decision-makers are faced with multiple objectives.

In this context policy decisions are made with little or no prospect of identifying an "optimal policy" in the conventional economic sense. Rather decisions, regarding the "best", or most attractive option, have to be based on a set of criteria. At this stage, therefore, a range of criteria need to be defined against which the objectives of the many players can be mapped.

For the purposes of this study a range of criteria were initially selected on the basis of the project teams' knowledge and understanding of animal health and welfare and regulatory policy and practice in the UK and elsewhere. A description of each of these is given below. These are grouped together under the headings of effectiveness, efficiency, equity and sustainability for ease of reference.

Effectiveness

Effect on animal health and welfare – to what extent is the policy likely to improve health and/or welfare?

Lags in impact - are delays likely before the measures take effect?

Risk and uncertainty - are there significant risks of policy failure or uncertainties surrounding the success of the policy?

Efficiency

Ease of design and implementation – are the structures in place for the policy to be implemented, will it be understood by the relevant actors?

Market effects on producers (compliance costs and impacts on competitiveness) - will producers be faced with high costs of compliance and will this have a significant impact on their ability to compete with producers in other countries? (See Table 4a).

Ease of monitoring and enforcement - is monitoring and enforcement likely to prove difficult (for example, because certain actions are difficult to detect or because of the large number of actors involved)?

Public sector costs - will the public sector face substantial costs of implementation? These would be costs to Defra and other public bodies which are ultimately borne by the taxpayer.

Use of technical (regulator) expertise - will good use be made of available expertise in animal production, health and welfare for the design and administration of the policy?

Scope for capture by stakeholders - might a particular group of stakeholders be able to gain and exploit a position of power and influence as a result of the policy?

Impact on other issues and policies – are there likely to be impacts (negative or positive) not directly related to the particular animal health and welfare issue (e.g. effects on other government policy objectives outside of health and welfare).

Equity

Legitimacy, accountability, fairness and transparency - is the policy likely to be acceptable to livestock owners, other stakeholders and the general public? Is it seen as an appropriate response to the problem, is it seen as fair to stakeholders (e.g. in terms of shares of responsibilities etc.), are the policy and its effects clear and visible to all concerned, is there a clear system of responsibilities and accountability in terms of, for example, monitoring and enforcement.

Sustainability

Scope for stakeholder participation - are livestock owners, and possibly other stakeholders, able to participate in (and take some responsibility for) policy implementation?

Flexibility - is there scope for adjustment and adaptation of the policy in the light of changing economic or technical circumstances?

Public acceptability – is the intervention likely to be seen in a positive or negative light by the general public and by different sectors of the public?

Matrix for policy assessment

Initially an attempt was made to assess each of the regulatory instruments against the above criteria, independently from the type of animal health or welfare issue being addressed. As before the assessment was limited to the entry of pluses and minuses in the matrix of assessment criteria against alternative policy instruments, shown in Table 4 (p.32). However, it was recognised during the workshop that the assessment of a particular regulatory instrument differs depending upon the animal health and welfare measure for which it is used. Hence although the matrix given in Table 4 provides a framework for assessing alternative regulatory measures used for animal health and welfare policy design, a different set of cell entries, of pluses and minuses, applies to each different animal health and welfare measure.

The process may be simplified in that the non-implementation of a particular veterinary or husbandry measure may be associated with a particular form of market failure. On the basis of Table 3 the relatively small number of appropriate policy instruments may be identified. It is only necessary to complete the relevant rows of the matrix for each of these policy instruments. This is the method used in the case study assessments (Chapter 9 and Appendix 2).

It was further recognised during the workshop that additional effects of policy instruments on three sectors of the market should be assessed as a part of policy evaluation, these being primary producers, others in the production chain, and consumers. For producers and others in the production chain the compliance costs and the effect upon competitiveness of a policy instrument may be integral to that instrument's success in addressing animal health and welfare problems. For consumers the impact of a measure on price and choice may dictate success or failure. The matrix for determining the market effects of policy instruments is shown in Table 4a (p.33).

Application of the matrix for policy assessment to responsibility and cost-sharing

Given the current interest in responsibility and cost-sharing in relation to animal health and welfare policy (e.g. Joint (Industry/Government) Working Group report on Sharing Responsibilities and Costs of Exotic Animal Disease, 2006), an attempt was made to assess, at a generic level, the attributes of each of the

regulatory instruments listed in the matrix where responsibility and cost-sharing are incorporated. The full details and results of this assessment are presented in Appendix 2, and the key findings are as follows;

1. Whilst being more equitable (to the taxpayer) the market effects of cost-sharing may be detrimental to the livestock industry, especially where the costs of overseas competitors may not include such contributions to disease control. However, this must be balanced against the theoretical reduction in risk of disease outbreaks which is commensurate with a more active involvement by livestock keepers in responsibility and cost-sharing.
2. The design and implementation of interventions incorporating responsibility and cost-sharing would require legislation; it would require the establishment of representative bodies for the farming industry and the establishment of a joint government-industry body (or bodies) to determine and agree to responsibility and cost-sharing *mechanisms* and *processes*. Given the possible effects upon third-parties of some interventions used within animal disease control, it would further require that these effects were taken into account, (e.g. by government representation) within these bodies.
3. It is assumed that the *effectiveness* of regulatory instruments in controlling animal health and welfare will be increased through the incorporation of responsibility and cost-sharing. However, this is dependant upon the exact nature of the cost-sharing mechanisms and processes which are adopted.
4. Responsibility and cost-sharing are assumed to reduce the total public sector costs of interventions, except for those based upon self-regulation. For self-regulation, public sector costs may increase although these would not be of the magnitude of other interventions and would be in line with public sector costs incurred in the regulation of other industries.
5. Scope for stakeholder participation is minimal within command and control and public compensation/ insurance interventions due to decisions being made on an industry-wide basis.

Table 4. Matrix of evaluation criteria against alternative policy instruments

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHW)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control														
Self-regulation														
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure														
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance														
Institutional arrangements														

Table 4(a). Matrix of market effects against alternative policy instruments

	Primary Producers		Others in Chain		Consumers	
	Compliance costs	Competitiveness	Compliance costs	Competitiveness	Price	Choice
Command & control						
Self-regulation						
Incentives & taxes						
Promoting competitive markets						
-Franchising & licensing						
-Contracting						
-Tradable permits and quotas						
Information, training & disclosure						
Direct action and public ownership						
Rights & Liabilities: laws						
Public compensation/ insurance						
Institutional arrangements						

8. Broader economic input

The framework described in this report (see p.12) takes the policy maker through the stages of the decision making process for developing and appraising animal health and welfare policy. Following the first stages, in which the animal health or welfare problem has been specified, the policy objectives clearly defined, and broad criteria used for selecting policy instruments, a detailed appraisal of policy interventions may then be necessary. However, by the end of stage 5 (detailed formulation of alternative courses of action/policies) it may be apparent that no intervention is justified or that the proposed measure is so limited in scope and cost as to not require further more detailed analysis. This chapter provides an overview of the principle tools that are used where these appraisals are justified.

Design of an appropriate policy response involves formulation of both a set of *feasible technical measures* for control of the disease or welfare problem and *appropriate policy instruments* for implementing these measures. The largely qualitative assessment involved in designing suitable options for the control of animal disease or health problems may in some cases suggest that no public sector intervention is justified. However, in other cases, where regulation appears to be justified, further quantitative policy appraisal is generally needed.

Policy appraisal

Here, as in other stages of the overall decision process, the development of broadly optimal policy measures needs close collaboration between veterinary epidemiologists and economists. The Treasury Green Book sets out principles for the analytical appraisal of central government policy options. This is based on the incremental costs and benefits, estimated by comparing the outcomes of the proposed policy option with the 'do-minimum' situation or the *status quo*. The benefits of animal health measures might be realised from reduced disease losses or, for example, from increases in livestock production.

Conventional analysis of this kind involves the use of 'discounting' to convert a series of annual "cash flows" for those costs and benefits that can be explicitly valued, into a single figure for assessment, such as the 'net present value'.

The task is to identify and where possible quantify and if possible value the costs and benefits of the proposed measures, in terms of the impact on the national economy, the distribution of costs and benefits between different stakeholders, possible impacts on the environment and other impacts on (human) welfare. Apart from the environmental impacts of animal disease, the implementation of control measures, such as the sanitary disposal of diseased carcasses or the culling of wildlife vectors, also affect the rural environment.

Much of the data needed, for instance on the incidence of a particular disease and its impacts on livestock production, must be derived from epidemiological analysis. Some of the information may be derived from *ex post* evaluation of past disease outbreaks and control measures. However, evaluation of past experience may be of limited value in the design and appraisal of new policies in a changing technical, economic and political environment and in dealing with emerging diseases. Hence policy appraisal may involve the prediction of uncertain future outcomes using simulation modelling.

Policy assessment is sometimes seen as a two-stage process, with the epidemiologist's contribution preceding that of the economist. Ideally the model building and appraisal should be a joint activity, with the economist contributing to the modelling of impacts of disease and control measures (at all levels from the farm up to the national economy) and to the identification of key variables.

Results of the economic appraisal may be presented and assessed in terms of point estimates of the average or 'expected money value' of those costs and impacts that can be valued in monetary terms. It is

normal practice where appropriate to conduct sensitivity analysis, by testing the effects of changing some of the key variables, to help assess the robustness and reliability of the results.

Risk assessment and risk management

Livestock production, like all agricultural activity, is subject to considerable risk and uncertainty. This may be due to fluctuations in markets and prices, changes in Government policy, lack of information or variation in the natural environment. Uncertainties regarding animal health (especially disease) and welfare are of particular policy importance. (A distinction is sometimes drawn between ‘risk’ as the case where the probability distributions of outcomes are predictable, and ‘uncertainty’, meaning a situation of imperfect knowledge, where probabilities of outcomes are not known or even where possible outcomes themselves are not known.)

A useful definition of risk in the present context is “the likelihood⁶ of occurrence and the likely consequences of an adverse event to animal or human health during a specified time period” (OIE 2004). Qualitative risk assessment is the process whereby likely possible outcomes are identified and their importance categorised (for instance as minor, moderate, or major) together with judgements of the likelihood of their occurrence (unlikely, moderately likely, or very likely). This is a simplification of what may be a complex process, but qualitative risk assessment is fundamental for the assessment of whether a policy intervention is justified and informs the appraisal of policy options. The use of Hazard Analysis & Critical Control Points (HACCP) may assist the qualitative risk assessment process. However, once the need for intervention has been recognised, the appraisal of alternative options generally requires more thorough quantitative risk assessment.

Quantitative risk assessment in the field of animal health generally involves epidemiological modelling, using estimated probability distributions for all the key variables, combined with assessment of the associated costs. Monte Carlo Simulation, based on drawing random samples from the estimated distributions, is one method of estimating the probability distribution of final costs and benefits. Scope is then provided for assessment on the basis of not only the mean expected money value but also the variability or spread of outcomes. This approach, known as quantitative risk assessment and management in the epidemiological literature (OIE 2005), might equally well be described (although not by economists) as ‘risk cost benefit analysis’ (Schrader-Frechette 1991). The results of this analysis are presented as a probability distribution of net benefits for each of the alternative control measures. The problem remains of choosing between risky alternatives, when reductions in risk are often achieved at the cost of reductions in expected or average net benefits.

Risk aversion and decision theory

Experimental trials and observation of human behaviour suggest that most people are “risk averse”, in the sense that an assured sum is preferred to a gamble with the same expected money value (EMV). A risk averse individual is willing to pay (or forego income) in order to reduce or avoid risk. Attitudes to risk depend on a number of factors, including the magnitude of outcomes (for example how serious or disastrous an outcome is perceived to be). An obvious example of risk aversion is illustrated by the willingness of most property owners to pay an insurance premium in excess of the expected value of the loss they are insuring against. Livestock producers adopt risk reduction strategies such as diversification and forward selling on contract and, in the case of disease, risk aversion practices such as vaccination and on-farm biosecurity. Defra has adopted a risk management strategy (Defra 2004).

Risk avoidance, or risk minimisation is generally achieved at the cost of a reduction in EMV of net benefits, or a rise in the EMV of net costs. Policy and risk assessors might be assisted in their analysis if provided

⁶ The terms ‘likelihood’ and ‘probability’ may be used interchangeably, although the latter term is more commonly used when referring to quantified risk, while ‘likelihood’ is used when risk is assessed qualitatively. ‘Likelihood’ has a more specific meaning in the context of Bayesian inference.

with more guidance on Defra's choice criteria in the face of risk. Very cautious, risk averse, choice implies a MAXIMIN criterion, which means choice of the option yielding the least bad of the worst outcomes (the worst possible outcome for each policy option is assessed and the least bad of these is chosen.)

A more balanced approach would be to assess the 'willingness to pay' for reductions in risk, measured either as variance of the distribution of net benefits or the probability of disaster. An approach sometimes favoured in economics textbooks is the estimation of the 'subjective expected utility' (SEU) of the decision-maker. The SEU is estimated on the basis of responses to a set of standard gambles, and is assumed to apply to other real world risky decisions. Critical technical difficulties for this approach are, a) how individuals' subjective utilities can be aggregated, b) whether the risk attitudes of public sector decision-makers reflect those of the general public and c) how future risks are accounted for in addition to the general problems of evaluating non-market benefits such as human health and animal welfare.

Quantitative assessment of animal welfare

The benefits of animal welfare policies are difficult to value in financial terms. However, there may be some improvements in productivity and in the prices received for the products of animal-welfare friendly systems. Animal welfare policy analysis does not need epidemiological risk modelling. Nonetheless there are still uncertainties that need to be taken into account, such as the probable compliance rate and there is a need to estimate the impact of the control measures on farm level management, costs and benefits (as well as their impact on animal welfare). The methods discussed above are also relevant in appraising animal welfare policies.

Economic tools contributing to policy assessment

Although it is likely that most appraisals of disease control policies will be based on both cost-benefit analysis and comparative risk assessment, a wide range of analytical tools may be used by economists in estimating costs and benefits. Some of these may be applied to the basic farm-level income and expenditure data that are collected annually from a nation-wide sample of holdings in the Farm Business Survey. Results are published annually by Defra for England and Wales and by the Provincial Agricultural Economics Centres, located in University and College Departments. These data together with the results of the National Agricultural Census provide much key information on agricultural production, livestock numbers, outputs, costs and profit margins.

However, other farm-level information needed for policy assessment, such as the expected costs and likely response of livestock producers to new control measures and willingness to pay or comply, may not be readily available. New investigations, using producer focus groups, rapid rural appraisal or formal surveys may be needed. Agricultural economists have substantial experience in applying all these methods. Similar techniques may be used to investigate impacts of new policies on other stakeholders in the market chain or the attitudes of members of the public regarding policies aimed at improving animal welfare.

A range of modelling methods are available for assessing financial, and other measurable, farm level impacts of animal disease and different health and welfare measures and instruments for their implementation. These include partial and whole farm budgets, econometric production function analysis, linear programming and its extensions, dynamic programming and simulation models. Such models are useful in assessing the potential impacts of new policies and may serve as less costly substitutes for the field investigations mentioned above.

Impacts at the national level are often assessed simply by multiplying the individual farm level results by the number of similar units in the whole economy. Similar calculations may be carried out for each main farm type and for each group of key stakeholders in the industry. This in effect is a form of aggregate budgeting. Alternatively all the forms of analysis discussed in the previous paragraph may be conducted at the national level using aggregated data inputs. Many industry level frontier production functions have

been estimated and whole country linear programming studies have been made. Of particular interest is the use of one or other of these approaches on total productivity indices for the whole agricultural industry (see Thirtle & Holding 2003). These measures allow comparisons of productivity change over time and separation of the effects of changes in technology from changes in efficiency. They also provide measures of the relative changes in productivity and competitiveness over time, between different countries.

Other aggregate level tools include econometric analysis of market supply and demand for particular commodities. These tools can be used to analyse the distribution of policy impacts between producers and consumers, particularly in relation to price incentives and technological change. Generally this type of market analysis relates to one commodity at a time. However, economists also have frameworks for exploring inter-sector flows and how these are affected by shifts in supply or demand, including those associated with foreign trade. The basic idea of input-output analysis, used for exploring inter-industry flows and the links between inputs and outputs, has been extended to the concept of the social accounting matrix (SAM). The latter involves the identification of different types of household and different firms and traces the resource and output flows between them. These tools, together with the more sophisticated computable general equilibrium (CGE) analysis, if developed in any detail, are very data demanding and time consuming to model. None the less they may prove useful in assessing inter-sector effects.

Much of this Report concerns applications of what has come to be known as the New Institutional Economics (NIE) which includes or overlaps with regulatory economics and much of the analysis relates to the concept of transaction costs. These relate to all kinds of interpersonal transactions, whether they are financial or not, and include the costs of information gathering, negotiating with the other participant, and enforcing the contract once agreed. Distinctions between private and public goods, the management of externalities, possible effects of information asymmetry such as moral hazard and systems of governance to limit transactions costs all fall under the NIE heading. The associated theories are useful in guiding the appropriate choice of policy instruments to implement animal health and welfare measures.

Monitoring

An important element in the continuous decision making process (Figure 3.1), is the need to monitor and evaluate the implementation and impacts of any action taken. This is of particular importance since data on the incidence and prevalence of disease and animal welfare issues is fundamental to their veterinary and economic specifications and definitions, and hence to the determination of appropriate policy interventions. Thus effective surveillance and monitoring is key to the allocation of government and industry resources to disease control.

Data capture is a critical component of good surveillance and how this is developed at an individual farm level is still a huge issue. In the main, most surveillance information is derived from laboratory diagnoses and statutory surveillance systems. Government veterinary surveillance, largely via the State Veterinary Service or in abattoirs through the Meat Hygiene Service, is aimed at detecting changes in the animal population to identify outbreaks of exotic diseases, the appearance of new diseases (particularly those which may have zoonotic potential) and changes in the occurrence or effects of known conditions.

The new Veterinary Surveillance Strategy (Defra et al, 2003) is a ten-year programme which aims to coordinate and improve the way this is done. This new strategy has come about following the BSE and FMD outbreaks and recognition of the need to identify emerging risks faster, thus enabling preventative and remedial control action to be taken more promptly. Its central objective is to create a mechanism for identifying disease risks.

Whilst a large part of the Government's approach to monitoring and surveillance is via a command and control mechanism often through the implementation of EC Directives, an interesting new approach is being advanced in Scotland by the Scottish Executive who, via their Animal Health & Welfare (AHW) Management Programmes, have signed up about 4000 farming businesses to the AHW Management options under their Land Management Contracts. A pilot is being run with the specific aim of allowing

farmers, with their vets, to analyse benchmarking indicators and identify possible reasons for the herd/flock not reaching its true potential and to compare their relative performance.

Surveillance and Monitoring by Species

The level of surveillance differs greatly between livestock species sectors. In general, the more integrated and organised the sector, the better the level of surveillance. Thus the pig and poultry sectors are well advanced whilst the cattle and sheep sectors have made little real progress despite some individual disease initiatives. Companion animals have few data and appear to lack a coordinated approach whilst the equine industry has recently developed some common approaches via the British Horse Industry Confederation Health and Welfare Strategy.

There has been little real progress in the development of a national programme of disease monitoring for wildlife. There are a few statutory schemes of restricted scope (e.g. the Wildlife Incident Investigation Scheme) and limited studies in universities and research institutes. As a result significant disease incidents may remain undetected and others may not be investigated fully, posing risks to the welfare and conservation of wildlife, the welfare of domestic animals and in some cases to human health. Coordinated national schemes for the surveillance of the health of wildlife are already established in France, USA and Canada and their best characteristics could be used to develop a scheme for the UK.

9. Case studies

Introduction

In order to test and develop the framework for developing animal health and welfare policy six case studies were conducted. Case studies were selected to provide a range of reasons for intervention (welfare, control of zoonoses, international trade, etc.) and a range of states of current intervention. The case studies were Foot and Mouth Disease (FMD), Porcine Reproductive and Respiratory Syndrome (PRRS), Johne's disease in cattle, Rabies, Scrapie in sheep and Sow Welfare in relation to the use of stalls and tethers. Case studies were brought together over three separate meetings of the project team, with the development of studies between these meetings and discussion and constructive review at the meetings themselves.

Within each case study the framework was followed from the identification of the issue to be addressed (stage 1) through to the formulation of alternative courses of action (stage 5), as shown in Figure 3.2 (p.12) and outlined below.

Stage 1. Identification of the animal health/welfare issue

e.g. rabies in dogs, PRRS in pigs, scrapie in sheep

The issues were defined from the starting point of the disease / animal health issue, rather than the intervention or policy mechanism e.g. 'sow welfare with respect to housing' cf 'the ban on stalls and tethers'.

Stage 2. Specification of the issue

Veterinary definition of the animal health and welfare issue initially included the following broad titles:

- i) animal welfare and zoonoses status (zoonotic / non-zoonotic / unknown or uncertain status)
- ii) disease reservoir (e.g. wildlife, farm animals)
- iii) transmission (e.g. aerosol, etc)
- iv) prevention
- v) control options
- vi) current interventions
- vii) historic interventions

Each of these factors was found to be relevant to the further definition and description of the disease or other animal health and welfare decision problem (stage A in the framework). Additionally, the following factors proved to be of use in forming an analytical description;

- viii) incidence / prevalence data
- ix) physical effects on animals
- x) impacts on production (mortality and morbidity in both exotic and endemic scenarios)
- xi) exotic or endemic
- xii) infectivity
- xiii) costs (perceived national costs of prevention and control)
- xiv) welfare impact
- xv) explicitness and assignment of disease consequences
- xvi) risk factors
- xvii) possible (alternative) veterinary interventions

From this veterinary definition, the issues were described in policy analytical terms; noting the risks, the principal actors and the reasons for market failure and so determining the justification (or not) for intervention.

Stage 3. Objectives of decision making

- i) A statement was made of policy objectives as they stand.
- ii) A statement was made of the reasons for intervention as highlighted by the analytical assessment of the veterinary specification.

This included the questioning of policy objectives. Table 1 was used to help understand whether policy objectives fitted with justifications for intervention?

Stages 4 & 5. Identification of possible courses of action and detailed formulation of alternatives

Two sets of considerations were made; possible veterinary actions (from 2, above) and possible policy intervention mechanisms.

The identification of possible policy mechanisms included a broad review of the possible mechanisms which were available and appropriate, using Tables 2, 3 & 4 to inform decisions.

The case studies are included in this report within Appendix 2. Review of the body of case studies and of the process of their development brought out the following issues relating to the use of the framework.

a) Linkage between veterinary and economics inputs

During the process of developing case studies it quickly became apparent that a close relationship between the veterinary and economics inputs was absolutely necessary in using the framework. For example, the assessment of animal welfare and the description and understanding of the physical effects of a disease upon an animal both require a veterinary understanding which may be difficult to quantify, but which may be central to forming a good understanding of the policy implications that disease, and dialogue between the professions was of considerable benefit in the clarification of these grey areas. Furthermore, there are specific areas such as the understanding of how disease impacts 'in the field' and understanding whether farmers can identify and treat diseases, which are best assessed by private practice veterinarians and which are critical for the policy analysis of the animal health / welfare issue.

b) Clarity of purpose

In all of the case studies the value of starting the review of policy options from the veterinary and economic analysis of the problem, and re-assessing the justification for intervention in the light of these, proved to be critical. Tackling of disease *per se* should not be the aim of policy; it should be tackling the important impacts of disease. The first stage of the framework must therefore be the definition of those impacts. A description of the veterinary and other impacts of the disease on a farm-scale and then nationally provides a sound basis for this definition. Johne's disease, for example, has separate, significant impacts; one is the risk of the disease in cattle leading to Crohn's disease in humans through consumption of meat or milk from infected cattle, another is the effect of the disease on the health and welfare of infected animals and the impacts on farm productivity.

The veterinary and economic analyses also require careful consideration of the exact nature of the stated animal health / welfare problem. As an example, for the case study examining the use of stalls and tethers in dry sow housing it became apparent that the problem to be addressed was dry sow welfare as it relates to housing, and that stalls and tethers were only one component of this. As for animal diseases, it is the impacts of animal husbandry that are of importance, not the husbandry practices themselves.

c) Attribution

The correct attribution of disease impacts is necessary if appropriate policy instruments, including market based solutions, are to be developed or promoted. In many cases disease and welfare impacts may not be correctly assigned to the disease or management system from which they arise. For example, stereotypic behaviours in pigs may not immediately be perceived by stockmen as indicative of poor welfare and the productivity effects of such poor welfare may not be explicit and tangible to producers, as seen in the sow tethering case study. In other cases, the impacts of a disease on animal health and welfare and on farm profitability may be little understood by farmers because of long-standing freedom from the disease, poor diagnosis by farmers or vets, or other problems masking the real issue.

d) The importance of the current starting point

The PRRS and FMD case studies are based upon highly contagious, high mortality and morbidity diseases, neither of which impacts, as far as is known, directly on human health. PRRS is controlled, to an extent, through voluntary industry actions relating to biosecurity. It has been allowed to become endemic, but is of lesser impact than when first introduced. FMD is controlled through command and control mechanisms and it remains exotic. Two particular factors separate the diseases. The first of these is that FMD control measures are in place on an international basis, and FMD-free status impacts on the UK's ability to trade internationally, whilst PRRS control is entirely at the discretion of industry and does not impact on our ability to trade other than creating a market for certified PRRS – free stock. Thus the starting point for policy assessments is critical and the question of 'what happens if we do nothing (i.e. do not intervene)?' is re-phrased as 'what happens if we do not change what we are now doing?'

e) The spread of diseases within and between species

The second factor separating PRRS from FMD is the difference in the populations vulnerable to the externalities of these diseases. PRRS is a disease of pigs which does not transfer to other species whereas FMD impacts upon a range of cloven hoofed animals. The immediate impacts of PRRS are upon pig farmers, of whom there are relatively few, with well defined industry bodies and with a clear capability to adopt and enforce their own voluntary control measures. The costs of these control measures, whilst borne by these producers, relate clearly to the benefits and remain within the small group of producers – they are "toll goods". In comparison, the producers affected by FMD are a far wider, more disparate group, without the clear capability to adopt and enforce their own voluntary control measures. The possibilities for freeloading (taking advantage of measures without contributing or participating) are far greater, and voluntary control measures cannot be relied upon.

f) Changes in understanding

The veterinary aspects of the diseases / welfare issues examined in this study change over time, following changes in, for example, the prevalence of the disease, ease of diagnosis / ability to diagnose or possible veterinary interventions, and they will change as knowledge and understanding of the epidemiology of that disease develops. Furthermore, the marketplace in which market-based solutions may be applied is also dynamic. There is therefore a need to set a maximum time limit between reviews of a disease; e.g. every two years, or to introduce an automatic review based upon set information triggers.

g) Risks and policies

The relative strengths of risks also indicate which policy instruments are appropriate to use. For example, the risks of developing Crohn's disease as a result of eating meat or drinking pasteurised milk from a dairy cow infected with Johne's may be deemed low, suggesting that policy instruments dependent upon voluntary uptake would be sufficient, whilst the risks of developing acute encephalitis and dying following close contact with a rabies infected dog may be deemed high, indicating that command and control type instruments would be more appropriate.

Overall the case studies demonstrated, in our opinion, that the framework provides a useful tool for policy development and appraisal. Using the matrix within case studies helped in identifying differences between various interventions and allowed for strengths and weaknesses to be readily assessed. Critically, it forces the user to consider policy options against a broad but consistent range of criteria, and allows the user to consider how policy options may be combined.

However, the use of the framework for policy development and appraisal in the 'real world' remains untested. If the framework is to be adopted and applied within Defra then it may be appropriate to run it in parallel with current practice so as to field-test the methodology prior to wider implementation.

The following points relating to the use of the framework in developing the case studies are of note:

i) Additional appraisal criteria

Whilst the insertion of additional criteria would create a more thorough evaluation matrix, this may be at the cost of ease of use of the matrix. However, for interventions designed to safeguard human health an additional column may be necessary to demonstrate the impact that interventions may have upon this factor.

ii) Disease profiles

Disease profiles are used for a variety of purposes but often do not include the wider impacts of the disease. Comparison of case studies (e.g. PRRS and FMD) highlighted the fact that similarities and differences between diseases may be better viewed through the development of disease profiles designed for the purpose of policy analysis. This would further allow for comparisons to ascertain the policy interventions which have been successful, or otherwise, for similarly profiled diseases. Because various factors combine for any one disease profile, this may be viewed as a decision-tree or checklist, covering the following factors;

endemic *or* exotic *or* environmental*
 +
 zoonoses *or* non-zoonoses *or* unknown status
 +
 high infectivity *or* medium infectivity *or* low infectivity
 +
 high *or* medium *or* low mortality / morbidity
 +
 multi- *or* single-species
 +
 high welfare impact *or* medium welfare impact *or* low welfare impact

* e.g. infertility, lameness

Choice of categories would require further assessment of the diseases impacting upon animal and human health.

iii) Disease control methods and suitability

An overview of all of the case studies indicates the benefits of developing a schedule of disease control methods for reference, and of providing an overview of how policy interventions relate to disease control methods. Disease control methods include vaccination, contingency planning, eradication, vector control, isolation, treatment, border control and movement control and biosecurity. For a particular disease, the control options which may be undertaken if that disease is present, or to prevent a disease outbreak must be specified in order for an economic assessment of these options to be made.

A provisional matrix of interventions against disease control methods was therefore developed by the team and is shown in Table 5, below.

Table 5. Provisional matrix of disease control measures against type of intervention

	Direct action	Command and control	Self-regulation	Incentives & taxes	Promoting competition	Information, training and disclosure	Rights, liabilities and laws	Public compensation insurance	Institutional arrangements
Border controls (quantitative)	+	++							
Border controls (technical specifications)		++							
Border controls (mandatory disclosure)						++			
Movement controls									
Bio-security			+	++		+			
Vaccination	(a)+	(a)++	(b)++	(b)+		(b)+			
Stamping out		++						+	
Vector control	(a)+	(a)++	(b)++	(b)+		(b)+			
Treatment of animals			++	+		+			
Isolation		(a)++	(b)++						
Surveillance	++	+	+	+		+		+	
Breeding for genetic resistance			+			++		+	+
Increasing space/head		++	+	+		+	+		
Appropriate methods of transport		++	+						
Adequate nutrition							++		
Level of health care		+	+				++		
Methods of slaughter		++	+						

(a) If used for national eradication programmes or maintenance of disease free status (b) Other situations where control of disease is not seen as a public good

10. Discussion

Animal health and welfare policy has been developed over a period of many decades, in response to a variety of disease threats and public concerns and within a changing political and economic context. This project therefore endeavoured to formulate a means for the consistent, rational development and appraisal of policy, and for the re-examination of current policy, within an analytical framework. Following a review of literature relating to the regulation of animal health and welfare, this framework was developed through the joint contributions of economists, veterinarians and industry experts and tested through a series of case studies.

The brief for this project set out eight specific objectives. Using the findings from the literature review, the development of the framework and the case study evidence these are examined below.

Market failure diagnosis and the rationale for government intervention

The risks associated with animal health and welfare give rise to the rationales for government intervention; the protection of human health, the protection of animal health and welfare, the protection of international trade and wider social goals. However, that there is a rationale for government intervention does not imply, directly or indirectly, a rationale for government *funding* of that intervention, nor does it imply that government has *sole responsibility* for such an intervention. Critically, it does not negate the responsibility of livestock keepers to maintain adequate standards of animal health and welfare and to act to minimise the risks of disease.

Options for managing risks and market based solutions

Government interventions to control the risks associated with the prevention and control of animal diseases range from the funding of research and provision of information, to the setting of minimum industry-standards for animal health and welfare, to the full command and control interventions whereby all decisions on animal movements and husbandry may be taken by the state. An examination of the various options for managing these risks indicates that for each of them some level of government intervention is normally necessary, and that each is suited differently to the various rationales for intervention. Hence, for example, the protection of public health during a disease outbreak may demand the certainty of command and control interventions, whilst the maintenance of a disease-free status may be best achieved through a combination of enforced self-regulation and public compensation.

Market based solutions may require information, in particular on disease incidence and disease control, baseline standards such as those set for animal welfare and adopted by industry assurance schemes and 'pump-priming', in particular where markets for 'disease free' goods can be developed (e.g. for major industry-led assurance schemes such as HI Health, where the market has failed to deliver these). However, whilst market based solutions may be appropriate for many aspects of disease prevention, they are not necessarily suitable for the stamping out of fast-moving, highly-contagious disease outbreaks. In these situations the command-and-control mechanisms traditionally implemented by government remain the most viable option.

Decision rules & mechanisms for intervention

The analytical framework developed in this project brings together a series of decision rules aimed at providing consistent, rational development and appraisal of policy and allows for the analysis of a range of mechanisms, including novel policy instruments, for state intervention.

Consideration of animal health and welfare using the framework, with contributions from economists, veterinarians and industry experts provided insights into disease and welfare problems and their control, which it is thought would be less easily forthcoming from a single veterinary or industry perspective. There

are good reasons for this. Formal analysis of the impacts of an animal health and welfare issue demands a precise description and a clear understanding of the problem, not simply in terms of animal health and welfare but in terms of the people involved and the various factors which may influence their behaviour in controlling the problem. Policy debate in animal health has tended to identify and then consider veterinary solutions in isolation, asking which is most appropriate for the control of disease. However formal analysis, reinforcing the veterinary data and experience with economic concepts, identifies the causes of market failure and assesses the possible interventions on the basis of these and all the impacts of alternative veterinary and other policy instruments..

It became very clear during the course of this project that from the outset there is a need for continual dialogue between economists and veterinarians in forming policy. The description of the problem in veterinary terms will inform the economic analysis, which in turn will demand that specific questions of the disease (e.g. prevalence, infectivity, mortality and morbidity effects) are answered. It is only when the veterinary understanding and the policy analytical framework is in place that the rationale for intervention and the various veterinary and policy mechanisms can be properly appraised. One consequence of this interdependence is that when and if the veterinary description of a disease changes – through the introduction of a new vaccine or the identification of a previously unknown virulent strain for example, then the policy implications of the disease may also be changed, calling for a reappraisal of government interventions.

The rationale for government intervention in animal health and welfare, set out in the first stages of the framework, provided a structure first of all for determining whether or not intervention is justified. By framing animal health and welfare issues in this way the broad decision criteria stated in the animal health and welfare strategy (to intervene when the market fails to deliver public health, animal welfare, economic or wider social goals) are further developed with a series of questions; e.g. where the market fails to protect animal welfare, who benefits from that welfare?, where the market fails to protect animal health, is this internal to the individual farm or the farming sector?, where the market fails to protect human health, what is the likelihood and what are the consequences of zoonoses? The analysis of the animal health and welfare issue within a formal framework poses these questions, and provides a firm base on which to consider whether or not a particular intervention is justified as the best policy option. It can be (inevitably) difficult for the policy maker to challenge current government policy. However the availability of a recognised analytical framework, supported by specialist advice, opens the door to rigorous questioning and, if appropriate, the promotion of alternative policy options.

The framework served to help select and develop policy instruments in each of the case studies. It raised questions over current policy interventions and the inconsistencies therein and it showed the team where and what information or data was critical in choosing policy instruments. However, the framework should be seen as a working document and applied to a number of further policy areas within animal health and welfare for it to be proven. The case studies herein, for reasons of time and resource limitations, looked at a small number of the possible interventions. Full case studies would by definition involve full policy development and appraisal. This may be undertaken as a means of field-testing the framework alongside Defra policy development and appraisal for a limited number of animal health and welfare issues that may be re-visited or which are in the current policy arena.

Strengths and weaknesses of mechanisms for intervention

The criteria detailed within the framework allow for the strengths and weaknesses of different mechanisms for intervention to be assessed, and the broad relationships between rationales for intervention and the mechanisms for intervention to be classified (see Table 3). However, the strengths and weaknesses of any one mechanism are dependant upon the precise nature of the animal health and welfare issue being addressed and upon the other mechanisms which may form part of the intervention. This is also true when responsibility and cost-sharing are considered; the mechanisms within which responsibility and cost

sharing are implemented and the nature of the animal health and welfare issues which these mechanisms are set to address will determine to a great extent the strengths and weaknesses of such an approach.

Optimal policy mechanisms and levels of intervention

The development of demonstrably *optimal* policy mechanisms was not thought to be possible within animal health and welfare, for the reason that there are too many differing objectives to be met, including differing target audiences from a variety of sectors. However, the notion of satisficing policy mechanisms, which meet criteria of effectiveness, efficiency, equity and sustainability, set out in the policy appraisal matrix, appears to be an appropriate tool in the development of interventions. That policy mechanisms should be tailored to specific circumstances was made clear within the development of case studies; the context of an animal health and welfare problem determining the content of any policies. Any one animal health and welfare problem may require a combination of interventions, perhaps relating to the differing reasons for intervention.

The analysis in Appendix 2 of the attributes of regulatory instruments incorporating responsibility and cost sharing (between government and industry) raised two important factors to be taken into consideration in any review of the levels of state intervention. First of all, the market effects of cost-sharing may be detrimental to the livestock industry if these are not mirrored within the industries of overseas competitors. This is balanced to an extent by the theoretical reduction in the risks of disease outbreaks (and commensurate improvements in bottom line performance for primary producers) which would be expected from a more active involvement in responsibility and cost sharing. However, such an 'active involvement' may not be achieved if decisions are made, albeit by appropriate farmer-representatives, at a national rather than a local level. Secondly, increasing the levels of responsibility and cost sharing (and thereby decreasing the levels of government intervention) may require government legislation, and the establishment of joint government-industry bodies to determine and agree to responsibility and cost-sharing mechanisms and processes. Again, these bodies must be genuinely representative of farmers if they are to successfully encourage active involvement in the responsibility for disease prevention and control.

Policy problems most amenable to public intervention

To gain the best value for Departmental-spend, it is worth considering which policy problems within the animal health and welfare arena are most amenable to government intervention, and which would give the highest returns from such intervention⁷. This first line of questioning might be re-phrased as 'what policy problems would give the most successful results in terms of responding to the four reasons for government intervention?' What policy problems would give the most successful results in terms of the protection of public health, animal welfare and the interests of the wider economy, environment and society and the maintenance of the UK's ability to trade internationally? From the case studies conducted within this project we know that a range of factors will influence whether or not interventions, and especially those interventions in which livestock keepers will share the responsibility and costs, are to be a success. Three factors in particular became apparent during this review; these being the correct attribution of disease and welfare impacts, the importance of the 'starting point' for interventions and the spread of diseases within and between species.

Where the impacts of a disease can be correctly identified with that disease by the practicing farmer or livestock keeper then any interventions, by government or by industry, are more likely to be successful; where the starting point for determining disease control measures is the interventions chosen historically then determining and implementing new measures will be less simple; where a disease can spread between different species, widening the 'externalities' to be considered, then the responsibility for disease

⁷ This second line of questioning is somewhat flawed, given that many of the returns from investment in animal health and welfare are first of all non-monetary, they may be difficult to estimate accurately and they are often not comparable.

control is less focused and the possibilities for freeloading are increased, reducing the chances of successful interventions.

Information requirements

For an effective use of economics within the development of animal health and welfare policy the ongoing surveillance and monitoring of diseases and other animal health and welfare issues is fundamental. Knowledge of the prevalence of diseases is critical not only in analysing risk but also in identifying where the ownership and responsibility for risks lie. For many diseases (e.g. sub-clinical cases of exotic diseases of companion animals) this requires expert knowledge and the maintenance of surveillance in the absence of any clear health or welfare problem.

Furthermore, if market-based solutions to animal health and welfare problems are to be encouraged, then such data might be seen to underpin their development. There is a broad base of privately owned information, within veterinary practices, which may be effectively utilised by government for surveillance purposes. This has been successfully achieved, for example, within the DACTARI scheme for reporting the incidence of exotic diseases in pets which have travelled abroad.

Further research and development

In examining how the veterinary and economic and wider policy aspects of health and welfare problems relate to each other, there would be clear benefit in developing a series of categorisations defined according to criteria designed to speed the identification of similar disease types and the policies which have been used for control. Furthermore, this would allow for the development of a bank of intervention types for diseases and welfare problems, such as the bundling of disease control measures seen for Johnes, Leptospirosis, IBR and BVD in cattle within an approved cattle health scheme or the development of industry protocols for disease control such as those seen for PRRS in pigs. This would also serve to provide exemplars of where disease control measures have been particularly effective. Rather than the detailed evaluation of single policies against single diseases, this would use the appraisal framework herein to provide insight into the economic similarities between diseases.

The policy analytical framework developed here needs to be tested within a 'real' (i.e. departmental) policy environment in order that it can be tailored to suit the working environment and procedures of policy makers. The framework should then be regarded as a 'working tool', to be developed and refined as it is used. Also, a more detailed exploration of the value of different economic tools and techniques in the analysis of animal health and welfare policy may prove useful in developing this framework further. A number of these techniques have been alluded to in the report, but there needs to be a comprehensive assessment of their potential value, their merits and limitations and the areas where they are likely to be most useful in the context of animal health and welfare policy.

There are various novel policy instruments which have been applied in recent years, for example in the areas of human health, transport and environment. The framework described in this report may now be used to explore the application of novel policies against a selection of distinct animal health and welfare issues. Moreover, *established* policy instruments used within other sectors (e.g. compulsory licensing and insurance of motor vehicles) might also be examined as to their use within the control of animal health and welfare.

Economics offers a range of analytical tools and techniques which can aid policy makers to make better, and more informed, decisions concerning animal health and welfare policies. Often, in the past, economic input has been applied at a later stage in the decision making process – for example to evaluate a policy decision after it has been made. Moreover, the perception of policy makers has sometimes been that the role of economists is merely to attach monetary values to outcomes (e.g. derived from epidemiological or other science-based models). This is in practice a very minor role of economics in the analysis of practical

public expenditure and regulatory policy. More important is its much more diverse qualitative and quantitative contributions to the kinds of analysis prompted by the framework presented in this report.

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**Economic Framework
Developing & Appraising Animal Health & Welfare Policy**

Workshop, 22nd November, Department of Agriculture, The University of Reading

Agenda

10.00 hrs Arrival, coffee and introductions

10.30 hrs Introduction to the workshop

10.40 hrs Economic rationale for regulation *
Policy instruments
Analytical matrix

Martin Upton and Richard Bennett will present papers covering the background economic rationale for regulation, a schedule of alternative regulatory instruments identified as applicable to animal health and welfare and a matrix of analytical tools by which these policy instruments may be assessed. These will then be opened for full critical discussion by attendees.

13.00 hrs Lunch

13.40 hrs Review of selected policy options

A selection of policy instruments agreed by attendees in the morning session shall be scrutinized in more detail, allowing the group to identify strengths and weaknesses in the analytical tools, and directing the project team towards appropriate case-studies by which to test these policy options further.

16.00 hrs Close

**Economic Framework
Developing & Appraising Animal Health & Welfare Policy**

Workshop, 22nd November, Department of Agriculture, The University of Reading

Attendees

Ross Adams	Policy Consultant, Livestock Strategy Division, Defra
Professor Richard Bennett	Department of Agriculture & Food Economics, The University of Reading
Roger Blowey, FRCVS	Wood Veterinary Group, Gloucestershire
John Bourne	Head of Animal Welfare Division, Defra
Tim Brigstocke	Director, Delta-innovation & Chair, Royal Association of British Dairy Farmers
Simon Harding	Deputy Director for Economics & Statistics, Defra
Joanna King	Agriculture Manager, Tesco
Dave Russell	Food Chain Analysis Division, Defra
Simon Scanlan	Food Chain Analysis Division, Defra
Michael Spackman	NERA Economic Consulting
Professor Alan Swinbank	Director of the Centre for Agricultural Strategy, The University of Reading
Professor Martin Upton	Department of Agriculture & Food Economics, The University of Reading
Roger Walsh	Livestock Strategy Division, Defra
Dr Steve Webster	Director, Delta-innovation

**Economic Framework
Developing & Appraising Animal Health & Welfare Policy**

Workshop, 22nd November, Department of Agriculture, The University of Reading

Dear Workshop Participant,

Thank you for coming to the Workshop on Developing & Appraising Animal Health & Welfare Policy on Tuesday 22nd November. Below are three tables that summarize our current thinking on the framework for the project.

Table 1 outlines the main reasons for regulation by government and/or others. We would be grateful if you could give some thought to the main categories of reasons for regulation and relevant examples applied to animal health and welfare.

Table 2 outlines the main categories of policy instruments and their application to animal health and welfare. Again, we would be grateful if you could give some thought to the following questions;

- (i) is this list complete?
- (ii) is this categorisation the best one to use (i.e. is there an alternative categorization that you think might be more useful for our purposes)?
- (iii) are there clear examples of these policy instruments applied in the field of animal health and welfare?

Table 3 presents some ideas for an evaluation matrix of the various policy instruments (taken from Table 2). The columns represent criteria for the evaluation of the different policy instruments. Please could you give some thought to the evaluation headings ~ are they comprehensive, are there any major considerations missing, could some headings be deleted, are the headings the best ones to use etc. Some headings are quite broad, for example, because single measures of efficiency might be difficult to determine. The evaluation is intended to be a broad assessment of policy instruments recognizing that there will be exceptions and that their success will often depend on exactly how they are implemented.

We look forward to discussing these and other issues with you next week.

THE PROJECT TEAM
17th November 2005

TABLE 1. RATIONALES FOR REGULATING (Market failure)

Rationale	Main aims of regulation	General example	Animal health & welfare
i. Monopolies and natural monopolies*.	Counter tendency to raise prices and lower output. Harness benefits of scale economies. Identify areas genuinely monopolistic	Public utilities	Professional veterinary practice in some developing countries Drug manufacture
ii. Windfall profits	Transfer benefits of windfalls from firms to consumers and taxpayers.	Firm discovers cheap source of supply	Holders of patent on critical drug in an emergency.
iii. Externalities (costs)	Compel producer or consumer to bear full costs of production rather than pass on to third parties or society.	Pollution	Disease spread Animal suffering
iv. Information inadequacies	Inform consumers to allow market to operate.	Pharmaceuticals, Food and drinks labelling	Lack/asymmetry of information on disease risks
v. Continuity and availability of service	Ensure socially desired (or protect minimal) level of "essential" service.	Transport services to remote regions	Provision of emergency veterinary services
vi. Anti-competitive behaviour & predatory pricing*	Prevent anti-competitive behaviour.	Below cost pricing in transport	Drug & vaccine producers
vii. Public goods and moral hazard	Share costs where benefits of activity are shared but free-rider problems exist.	Defence & security non-services. Health services	Biosecurity. Non-compliance. Welfare, wildlife environment.
viii. Unequal bargaining power	Protect vulnerable interests where market fails to do so.	Health & safety at work	Vets. & farmers & drug companies
ix. Scarcity & rationing	Public interest allocation of scarce commodities.	Petrol shortage	Disease control services in an emergency
x. Distribution justice & social policy	Distribute according to public interest. Prevent undesirable behaviour or results.	Victim protection Discrimination Compensation	Disease outbreaks and compensation
xi. Rationalization & coordination	Secure efficient production where transaction costs prevent market from obtaining network gains or efficiencies of scale. Standardisation.	Disparate production in agriculture & fisheries	Necessary for national disease control/eradication
xii. Non market objectives	Future generations. Altruistic objectives	Environment	Animal welfare

Listing Alternative Policy Instruments

A list of alternative regulatory strategies, applicable to a wide variety of types of public service provision, including key “utilities” is given in Table 2, together with possible applications in the field of animal health and welfare.

Table 2. . ALTERNATIVE REGULATORY STRATEGIES

Strategy	General example	Animal health & welfare
1. Command & control	Health & safety at work	Animal movement control. Minimum space rules for pigs & poultry.
2. Self regulation	Insurance industry	Farm assurance schemes, veterinary profession, industry codes of practice.
3. Incentives and taxes	Differential tax on leaded & unleaded petrol	Contingent payment of subsidies. Cross compliance. Pillar II monies for farm health plans. Carcase disposal.
4. Promoting private markets	Office of Fair Trading Airline industry. Telecommunications	Drug companies.
a) Competition laws		
b) Franchising	Rail, television, radio.	Drug or vaccine manufacture?
c) Contracting	Local authority refuse services	Hire of private vets. to provide public services.
d) Tradable permits	Sulphur dioxide emissions (USA)	Milk quotas but animal health/welfare??
5. Disclosure	Mandatory disclosure in food/drink sector.	Reporting of List A diseases Labelling
6. Direct action	State-supplied work premises	Control of epidemics. Border controls.
7. Rights & liabilities: Laws	Rules of tort law: right to light or clean water??	Prevention of cruelty to animals. Five Freedoms, sentient beings.
8. Public compensation/ social insurance	Workplace safety schemes (USA, Canada, Japan, New Zealand)	Compensation for animals slaughtered for disease control or welfare reasons. Livestock disease insurance schemes.

* Important considerations are the institutional arrangements (e.g. Agencies etc.), the role of partnerships and enabling role of government– how should we best deal with these aspects?

A matrix of assessments of policy instruments

These lists of policy instruments may provide one axis of a matrix (or matrices) for comparing alternatives by a range of different criteria. Suggested outlines are given in Table 3, with suggested criteria for comparison as the column headings.

Currently the remaining cells are left blank. Given that the matrix is intended to serve as a summary of the review of alternative options, it is suggested that each cell should include

- a) a guide to the relevance, strength or weakness, of the corresponding policy instrument to the given criterion of assessment, using ticks and crosses or plus and minus signs.
- b) a reference (using letters or numbers) to the relevant textual discussion elsewhere in the report.

TABLE 3: EVALUATION of ALTERNATIVE REGULATORY STRATEGIES

	Market effects on producers (compliance costs, competitiveness)	Lags in impact	Public sector costs	Ease of monitoring and enforcement	Legitimacy, accountability fairness transparency	Use of technical (regulator) expertise	Scope for capture by stakeholders	Scope for stakeholder participation	Flexibility	Risk and uncertainty
Command & control										
Self regulation										
Incentives										
Promoting competitive markets										
Franchising										
Contracting										
Tradable permits?										
Disclosure										
Direct action										
Public compensation/ insurance										

Criteria that might be added? - Ease of implementation, supported by legal framework?

Appendix 2. Application of the matrix for policy assessment to responsibility and cost-sharing

Introduction

Government, livestock keepers and others along the food supply chain undertake actions to reduce the risks associated with disease and takes measures to try to protect animal welfare. Government has played a central role in controlling exotic disease incursions and outbreaks, for example through border controls and through disease eradication policies. The costs of these activities have been met for the most part by government and paid for by taxpayers.

Following experiences of exotic disease outbreaks such as that of FMD in 2001, there is a question as to whether the current form of government intervention in control of (principally) exotic disease is the right approach or whether it would not be better to have a new system of sharing responsibilities and costs of disease control between government and livestock keepers and perhaps along the food supply chain.

In a number of countries movements have been made towards the sharing, between government and the livestock industry, of both the responsibility for, and the costs of, controlling animal diseases. Australia introduced such a system in 2002, and livestock production industries in the Netherlands, France and Germany each contribute to the cost of dealing with disease outbreaks in their own country.

The Animal Health and Welfare Strategy (Defra, 2004) had as its aim to '*develop a new partnership in which we can make a lasting and continuous improvement in the health and welfare of kept animals while protecting society, the economy, and the environment from the effects of animal diseases*'. The publication '*Partners for Success – a farm regulation and charging strategy*' (Defra, 2005) has highlighted the importance of better regulation and the need for partnership working between government, industry and other stakeholders. Recently, a joint industry-government working group has made recommendations concerning the sharing of responsibilities and costs of exotic animal disease (Defra, 2006).

The focus of this report is upon the role of economics in developing and appraising animal health and welfare policy. It is therefore pertinent to examine how the findings herein inform the current debate on sharing the costs of, and responsibilities for, disease control. Whilst the framework developed within this report is intended for use on specific disease and welfare issues, it is nevertheless worth examining how cost and responsibility sharing stand up to scrutiny against some of the key measures.

TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS WHERE RESPONSIBILITY AND COST-SHARING ARE INCORPORATED

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHW)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control	--	++	-	++	++	-	++	++	--	++	0	0	-	+
Self-regulation	++	++	++	++	++	++	+	-	+	-	0	+	++	-
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure	--	-	++	++	++	++	+	--	++	++	0	++	++	-
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance	--	++	-	++	++	++	++	++	-	++	0	+	-	+
Institutional arrangements														

Command and control (incorporating responsibility and cost-sharing)

'Whereby decisions upon the management of animal health and welfare are taken by the public authorities and statutory instruments are used to enforce the rules of behaviour. Within the scope of regulations, there is no scope for private individual decision making. This category includes animal movement controls and border controls, interventions which are highly relevant to the control of animal diseases and in particular to zoonoses'. [p.18]

Given the extent to which command and control interventions contribute to the total costs of animal health and welfare control, they are particularly relevant to responsibility and cost sharing. [can we state that command and control interventions have been at the forefront of discussions within the JIGWG?]

Ease of design and implementation: suitable bodies are necessary to determine responsibility and cost-sharing mechanisms, as are the mechanisms for charging a levy to cover non-government contributions. Would require legislation. (--)

Ease of monitoring and enforcement: the means of monitoring and enforcement of responsibility and cost sharing may be adapted from current mechanisms. (++)

Flexibility: command and control interventions are not by their nature flexible; adaptation to new situations would require agreement across many parties and risk forecasting/horizon scanning essential to allow adaptation to changing conditions. (-)

Legitimacy: government perception is that the current situation is unfairly biased in favour of farmers (reference), balanced by farmers' perceptions that they are powerless to act in the face of exotic diseases. Changes to a responsibility and cost sharing system could increase perceptions of legitimacy and accountability from farmers and government alike. (++)

Public acceptability: the introduction of responsibility and cost-sharing should not impact upon the public acceptability of command and control measures. (++)

Use and supply of technical (regulator) expertise: decisions on responsibility and cost sharing will require regulation which is independent of either party. (-)

Effectiveness (on AHW): the disconnection between responsibility and costs of disease control and the interventions used for exotic diseases has been stated as a reason for the failure of previous interventions. It is assumed that the closer linkage between responsibility and costs of disease control and the interventions used will lead to a greater effectiveness. (++)

Lags in impact: command and control interventions can be relatively quick, and supported by state organisations and power, thereby minimising any delay in implementation. (++)

Market effects: liable to increase the costs to producers in the short term although longer term benefits (of disease avoidance) considerable. Equivalence with systems in competitor countries preferable. (--)

Public sector costs: traditionally very high for command and control interventions, responsibility and cost sharing offers the chance to reduce these. (++)

Impact on other issues and policies: none that are obvious. ()

Scope for capture by stakeholders: low, as fully regulated ()

Scope for stakeholder participation: only through regulatory bodies, therefore low. (-)

Risks and uncertainty: few, except that low levels of flexibility do not allow for rapid adaptation to new situations (+).

Self-regulation (incorporating responsibility and cost-sharing)

'Whereby the government lays down general objectives, and entrusts the task of delivering and enforcing detailed rules to a body representing those in the sector. This approach may be based on voluntary initiatives, with little or no outside intervention. However, incentives may be offered through assisted funding, and the self-regulation is monitored to some degree and in some cases enforced by government.' [p.18]

This is a form of intervention for which by definition a large degree of responsibility and cost sharing would be expected and it includes farm assurance schemes operating for animal welfare and for animal health.

Ease of design and implementation: Relatively easy to design, with no formal legislation necessary. Bodies already in place (++).

Ease of monitoring and enforcement: May be adapted from or added to mechanisms already used for assurance schemes (++).

Flexibility: No formal legislation constraining useage, and may be adapted to regional or other circumstances (++).

Legitimacy: May be operated for animal keepers, by animal keepers (++).

Public acceptability: Market forces should drive standards etc, to be within the bounds of public acceptability. (++)

Use and supply of technical (regulator) expertise: No regulatory expertise required. (++)

Effectiveness (on AHW): Dependant upon scheme, extent of farmer participation, and extent to which it can be pro-active in encouraging biosecurity, animal welfare etc. (+)

Lags in impact: Dependant upon industry buy-in (-)

Market effects: By definition can be market-driven – minimal effects on markets (+)

Public sector costs: Minimal, although pump-priming of schemes may be necessary (-)

Impact on other issues and policies: None

Scope for capture by stakeholders: Great – although within bounds of the market for assurance schemes etc (+)

Scope for stakeholder participation: Great and fundamental to success (++)

Risks and uncertainty: Success dependant upon choices of farming population, therefore relatively high risk of failure (-).

Disclosure and other measures to improve information flows (incorporating responsibility and cost-sharing)

Disclosure is the mandatory reporting of, for example, disease incidence. Statutory reporting of disease is a commonly used intervention within animal health and welfare. More generally disclosure relates to the provision of information and may be linked with research, training and the dissemination of knowledge.' [p.19]

Responsibility for reporting diseases already sits with animal keepers. However, the sharing of responsibilities and costs relating to the provision of information (research, training and knowledge dissemination) may also be examined.

Ease of design and implementation: Information campaigns are an integral part of the livestock industry and are often conducted jointly between industry and government. However, investment in research (necessary to combat animal disease and to generate such 'information') is more difficult to justify on a per-farm basis, especially because of non-commercial nature of information and necessity for a continuous research base. Where farmer-funded research exists it is generally in the area of field-testing government sponsored research. (--).

Ease of monitoring and enforcement: Information flows cannot be guaranteed, although it is possible to monitor the uptake of information by livestock keepers (+)

Flexibility: Highly flexible (++)

Legitimacy: Cost sharing for information campaigns easily justified on the basis that livestock keepers benefit through improved animal health and government benefits through animal welfare public good (++)

Public acceptability: As above (++)

Use and supply of technical (regulator) expertise: None necessary (++)

Effectiveness (on AHW): Relatively high although by no means 100% (+)

Lags in impact: Slow, due to necessity for repeated messages(-)

Market effects: None, costs minimal, (++)

Public sector costs: Minimal (++)

Impact on other issues and policies: None that aware of ()

Scope for capture by stakeholders: Campaigns may be sponsored and information may be re-branded and remarketed (++)

Scope for stakeholder participation: Success dependant upon participation (++)

Risks and uncertainty: Success dependant upon responses of farming population, therefore relatively high risk of failure (-).

Public compensation / insurance (incorporating responsibility and cost-sharing)

“Where compensation is paid or insurance provided for disease losses. This may be, for example, where disclosure of disease is encouraged through a financial incentive or, preferably, through the removal of financial disincentives.” [p. 20]

Compensation has been an integral part of the UK’s animal disease control measures, based perhaps in part on considerations of equity, but also on the need to remove the financial disincentive to reporting notifiable diseases. To date, the funding of compensation, and determination of the levels of compensation payable, have been undertaken by government.

Ease of design and implementation: suitable bodies are necessary to determine responsibility and cost-sharing mechanisms, as are the mechanisms for charging a levy to cover non-government contributions. Would require legislation. (--)

Ease of monitoring and enforcement: the means of monitoring and enforcement of responsibility and cost sharing may be adapted from current mechanisms. (++)

Flexibility: flexibility may be designed into cost and responsibility sharing mechanisms relating to public compensation and insurance, including for example the frequency with which compensation and levy regimes are reviewed. Difficulties with new and emerging diseases for which disease impacts and control measures are unknown and these may require separate treatment. (-)

Legitimacy: The principle beneficiaries of public compensation and insurance are livestock keepers and sharing responsibility and costs could increase perceptions of legitimacy and accountability from farmers and government alike. (++)

Public acceptability: the introduction of responsibility and cost-sharing should not impact upon the public acceptability of public compensation / insurance measures.(++)

Use and supply of technical (regulator) expertise: Decisions on how costs and responsibility should be shared within public insurance and compensation schemes would be negotiated between parties before disease outbreaks occurred, and the use of a regulator should not therefore be necessary. (++)

Effectiveness (on AHW): the disconnection between responsibility and costs of disease control and the interventions used for exotic diseases has been stated as a reason for the failure of previous interventions. A greater linkage between the costs of compensation and the benefits to the compensated should theoretically improve disease control at farm-level. (++)

Lags in impact: public compensation and insurance are means of encouraging the reporting of notifiable diseases and this would be the same regardless of responsibility and cost-sharing measures. (++)

Market effects: likely to increase the costs to producers in the short term although longer term benefits (of disease avoidance) considerable. Equivalence with other countries preferable. (-)

Public sector costs: traditionally very high for public compensation and insurance, responsibility and cost-sharing offer the chance to reduce these. (++)

Impact on other issues and policies: none that are obvious ()

Scope for capture by stakeholders: there is potential to introduce compensation through the private insurance market (e.g. with a minimum of ‘third part insurance’ as a pre-requisite to livestock keeping ~ in parallel with compensation and insurance used for motorists), thereby placing both the responsibility and the cost firmly in the hands of livestock keepers. This may be limited by a) the number of insurers who would consider this to be a viable proposition and b) the levels of information required by insurers to accurately and fairly base their premiums. (+)

Scope for stakeholder participation: only through regulatory bodies, therefore low (-)

Risks and uncertainty: few, except that the linkage between reporting notifiable diseases and the payment of compensation should be maintained if high levels of notification are to be maintained. (+)

Conclusions.

Reviewing the regulatory instruments detailed in table 4, where responsibility and cost-sharing are incorporated the following points are of note;

1. Whilst being more equitable (to the taxpayer) the market effects of cost-sharing may be detrimental to the livestock industry, especially where the costs of overseas competitors may not include such contributions to disease control. However, this must be balanced against the theoretical reduction in risk of disease outbreaks which is commensurate with a more active involvement by livestock keepers in responsibility and cost-sharing.
2. The design and implementation of interventions incorporating responsibility and cost-sharing would require legislation; it would require the establishment of representative bodies for the farming industry and the establishment of a joint government-industry body (or bodies) to determine and agree to responsibility and cost-sharing *mechanisms* and *processes*. Given the possible effects upon third-parties of some interventions used within animal disease control, it would further require that these effects were taken into account, (e.g. by government representation) within these bodies.
3. It is assumed that the *effectiveness* of regulatory instruments in controlling animal health and welfare will be increased through the incorporation of responsibility and cost-sharing. However, this is dependant upon the exact nature of the cost-sharing mechanisms and processes which are adopted.
4. Except for within interventions based upon self-regulation, responsibility and cost-sharing are assumed to reduce the total public sector costs of interventions. For self-regulation, public sector costs may increase although these would not be of the magnitude of other interventions and would be in line with public sector costs incurred in the regulation of other industries.
5. Scope for stakeholder participation is minimal within command and control and public compensation/ insurance interventions due to decisions being made on an industry-wide basis.

Case studies

Six case studies were performed using the framework, and these are detailed on the following pages as follows;

- Johnes Disease in cattle A(ix)
- PRRS – Porcine Reproductive and Respiratory Syndrome in pigs A(xv)
- Sow Welfare (with specific reference to housing) A(xxi)
- Scrapie in sheep A(xxvii)
- Rabies A(xxxiv)
- Foot & Mouth Disease A(xli)

Stage 1: INDICATION OF THE ANIMAL HEALTH / WELFARE ISSUE**Johne's Disease in cattle****Stage 2: SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE****Veterinary definition****A. Description of the Disease.**

Johnes is an endemic infection in many UK dairy and beef herds. It has a low rate of transmission and spreads slowly from the index case, due to the very long (2 – 4 year) incubation period. Calves are mainly infected during the first month of life and disease is most commonly seen at 2-6-years old.

A1. Incidence – Gunn & Caldow (2000) estimated that 20% of UK herds are infected although this may be a serious under-estimate. In both Holland and Denmark, survey data is showing that 55-60% of herds are infected although data from the USA indicates a similar level to the SAC findings. Australia which has a much vaunted eradication programme has around an 11% incidence. Data from VLA/SAC via VIDA over the past 10 years shows that between 1995 to 2000 there was a steady increase in the number of diagnoses from around 700 incidents in 1995 to just over 1000 in 2000. Since then the number of diagnoses has more than doubled. In 2004 there were 2400 reported incidents of Johnes's Disease in Great Britain.

A2. Physical effects – mainly wt loss and scouring, advanced cases become unsteady on their legs and eventually recumbent, but most are culled before this stage. At present affected animals can enter the food chain provided they are not emaciated

A3. Impact on production – milk loss, weight loss, reduced fertility, reduced value of cull cow or bull, early culling

B. Categorisation and Description of the Problem.

Control of Johnes is necessary because of:

B1. Financial impacts. Affected animals loose weight and are culled early, thus increasing replacement costs. This will be especially important at the end of the OTMS Scheme, when animals in poor bodily condition will have a zero or negative value

B2. Animal welfare. There is no known treatment.

B3. Potential zoonosis. Although being by no means proven, there is a proposed link between Johnes in cattle and Crohn's Disease in man and this led to an increase in pasteurisation times in milk 2-3 years ago.

C. Reservoir and Transmission of the Disease.

Cattle are the main reservoir and cattle to cattle transmission is the most common. Sheep and goats are also affected by Johnes, and in wildlife rabbits and deer are known to be carriers.

The major routes of transmission are:

- Faeces, especially when the dam is clinically affected. Faeces contain a very large number of organisms.
- Colostrum
- Milk, especially in the clinical case
- Trans-placental
- Fomite vectors, e.g. feedstuffs contaminated by faeces.

D. Prevention.

Biosecurity is the most important aspect of prevention i.e. purchase from a certified Johnes free herd (of which there are currently none), good fencing to prevent access and tactile contact from other cattle.

E. Control Options.

There are a range of control options on endemically infected farms.

- E1.** Hygiene. For example single penning of dam and calf to avoid cross-suckling and faecal contamination. Avoid faecal contamination of feedstuffs and avoid feeding residual food from dairy cows (which might be contaminated) to young stock.
- E2.** Feed colostrum from the dam to its calf only and do not feed pooled colostrum.
- E3.** Feed milk powder.
- E4.** Pasteurisation of milk and colostrum would be of considerable value and is carried out in North America.
- E5.** There is no known treatment
- E6.** In infected herds, a test and cull policy can be implemented, but because carrier cows do not test positive until the later stages of the disease, ie just before they show clinical signs, and well after they have been excreting infection for several months, this is not commonly carried out
- E7.** In infected herds, the offspring of known positive dams are often marked so that their milk and colostrum is never fed to calves

F. Review of Current Interventions.

- F1.** Historic – prevention of access to drinking water from ponds and streams, as part of the early stages of TB control, helped in the reduction of Johnes. Disease has increased in recent years because of larger herd size.
- F2.** The disease has increased in incidence over the last 5-10 years, primarily associated with large herd size and the feeding of colostrum. Hence Government support for the installation of processing plants for both colostrum and especially for waste milk would go a long way towards reducing the problem. 'First feed' colostrum to a calf should be from the dam (unless she was an offspring of a known affected cow), thereafter all feeds would be pasteurised.
- F3.** The Government could also support the establishment of certified Johnes-free herds, by promoting a Cattle Health Scheme. This has been done in other Countries, eg Australia, where a test and cull scheme has been implemented, but it has not been successful.
- F4.** An alternative is to invest in an eradication programme. Unfortunately the lack of sensitivity of the available diagnostic tests makes it difficult to identify infected animals during the long preclinical period and even if infected animals are removed there is a risk that Map may persist in other domestic or wild species or survive in the environment. Vaccination is expensive (about £10 per dose). Moreover it does not significantly reduce the number of cattle infected in all herds. Vaccinated animals sold to other herds can transmit the organism, and can cause difficulty with the interpretation of the TB herd test whilst the use of a live vaccine is a hazard for operators.
- F5.** Current - The current Government intervention is to support a voluntary initiative whereby the Industry is encouraged to control the disease. A pamphlet on control in beef herds is enclosed.

Other factors contributing to the description for policy analysis

See Table 1: strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --

1. Endemic disease, effects on production largely internal to the market with impacts on output, revenue and costs of producers (--) (But farmers not always aware).
2. Because of its widespread nature (hence affecting the cattle/livestock industry to some extent) and the fact that it can spread from producer to producer (third party effect) there is some argument (+) for government intervention.
3. There may be some costs and benefits for international trade in meat and milk due to Johnes. Some of this is internalised to the individual producer (e.g. sales of live animals) but some also affects the reputation of British meat and milk (+).

4. Some negative animal welfare impacts (negative externalities) due to the disease. Given the 'public good' nature of animal welfare, there is also some justification for government intervention on animal welfare grounds (+).
5. Potential risk (currently unproven) to human health (negative externality of disease) also provides a reason for government intervention to protect public health (++) (although this may be by controls on food rather than livestock disease control).
6. Information lack and asymmetries – concerning the disease and its impacts – provides some reason for government intervention (+).

Stage 3: POLICY OBJECTIVES

1. To reduce prevalence (improve health and welfare) – possibly eradicate? (National Control Programme encouraged by govt.)
2. To protect human health (increase in pasteurization time).

Questioning the rationale for intervention

Only protection of public health is a potential strong justification for government intervention on Johnes (++).

Stage 4: POSSIBLE COURSES OF ACTION/POLICY INSTRUMENTS

Externalities and public goods (++) → command and control (++) , enforced self regulation (++) , incentives and taxes (++) and/or direct action (+ or ++)
 Information asymmetries → information/ disclosure (++)
 Social goals (equity to farmers etc.) → direct action (++)

Command and control options: compulsory testing, compulsory slaughter, meat inspection, increased pasteurization for milk and heat treatment of colostrum.

Enforced self regulation options: national control programme (hygiene, biosecurity etc. as part of a herd health plan – with the possibility of combining with initiatives for other diseases such as BVD and IBR), Johnes assured status for herds, and vaccination.

Incentives and taxes options: producers being paid a grant for herd health planning/Johnes control and Johnes control being a farm assurance requirement.

Direct action options: government contracting the SVS to go onto farms to test for Johnes and to cull positive herds.

Information options: compulsory disclosure (i.e. Johnes as a Notifiable Disease)

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TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS – JOHNES DISEASE IN CATTLE

	Ease of design and implementation (e.g. supported by legal framework?)	Ease of monitoring and enforcement	Flexibility	Legitimacy, accountability, fairness transparency	Public acceptability (media PR, customs etc.)	Use and supply of technical (regulator) expertise	Effectiveness (on AH&W)	Lags in impact	Market effects (see below)	Public sector costs	Impact on other issues + policies	Scope for capture by stake-holders	Scope for stakeholder participation	Risk and uncertainty
Command & control:														
Increase milk pasteurisation¹	++	++	++	++	++	++	-	++	++	++	?/+	++	+	++
Heat treat colostrum²	--	--	0/+	0	?/+	-	+	-	-	0/-	?	+	?	-
Self regulation														
Test and accreditation³	+	-	0	+	+	+	+	-	+/-	+	+	+	++	+
Incentives and taxes														
Promoting competitive markets														
Franchising and licensing														
Contracting														
Tradable permits and quotas														
Information, training and disclosure														
Direct action and public ownership														
Rights & liabilities: Laws														
Public compensation/ insurance														
Institutional arrangements														

Market effects – compliance costs (CC) and competitiveness (Co)						
	Primary Producers		Others in Chain		Consumers	
	CC	Co	CC	Co	Price	Choice
Command & control						
	+	+	+	+	0	0
Increase pasteurisation time¹						
Heat treat colostrum²	--	-	0	+	0	0
Self regulation						
Test and accreditation³	0/-	+	0	0	0	0
Incentives and taxes						
Promoting competitive markets						
Franchising and licensing						
Contracting						
Tradable permits and quotas						
Information, training and disclosure						
Direct action and public ownership						
Rights & liabilities: Laws						
Public compensation/insurance						
Institutional arrangements						

¹ Milk pasteurisation is the major milk processing activity (nearly all milk in the UK is pasteurised) and is a tried and tested, well established and accepted process. This means that it is relatively easy to implement a minor change to the pasteurisation temperature and/or time, easy to monitor and enforce with a high level of public acceptability, little uncertainty etc. and very little additional cost to anyone. Although this policy protects public health it would not do anything to improve animal health (hence this aspect has a -).

² Heat treatment of colostrum on the farm would require specially purchased equipment and additional collection and handling of colostrum on the farm. This is not likely to be easy to implement nor to obtain adoption/compliance by producers, since the benefits may not be widely accepted. It will also incur increased costs for producers, increasing costs of production and so could impact adversely on competitiveness. However, it is likely to have a positive impact on animal health (if complied with), preventing infection of young stock through infected colostrum.

³ An industry regulated, voluntary scheme for testing and accreditation ('Johnes free' herds) would be relatively easy to design and implement (similar schemes have been successfully implemented in other countries – although some have been enforced) but uptake of the scheme may be limited unless it becomes a requirement of assurance schemes (beef and dairy). Legitimacy and public acceptability would be relatively high for such a scheme and, depending on uptake, it should have a positive impact on animal health and welfare. Lags in impact may be relatively long if producers are slow to join the scheme. It should not add greatly to production costs and could have a net positive benefit on competitiveness for those selling cattle. As part of a herd health plan, the scheme could embrace other diseases, such as IBR and BVD. Although this would increase costs of compliance, a number of (e.g. monitoring, administration etc.) costs would be spread across several diseases, benefits of disease-free status would be greater for individual producers and the positive impact on animal health and welfare would be larger.

The above analysis suggests that, on balance, increased pasteurisation time is a good (+) policy on the criteria considered whilst heat treatment of colostrum is not (-). A self regulated system of testing and accrediting Johnes free is generally favourable but may not be easy to enforce and may take some time before it takes effect. A scheme which includes other diseases as well as Johnes (such as IBR and BVD) would spread some of the cost, potentially have increased benefits to producers and provide a greater improvement in animal health and welfare.

Stage 1: INDICATION OF THE ANIMAL HEALTH / WELFARE ISSUE**PRRS – Porcine Reproductive and Respiratory Syndrome****Stage 2: SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE****Veterinary definition****1. Description of the Disease**

PRRS is a viral infection of pigs causing a range of clinical signs. It is strongly immuno-suppressive, especially in its destructive effects on the pulmonary macrophage, and hence clinical signs of respiratory disease are the most common. Reproductive disorders also occur. Virus spreads relatively slowly through a pig herd and the rate of spread is difficult to predict. In some herds, the disease is self limiting and the herd returns to a PRRS free status.

A1. Incidence – no national monitoring, but estimate is that 60% of herds are infected

A2. Physical effects – in the initial breakdowns sickness and mortality in sows (max 5%), increased mortality in finishing herd (approx. + 5%), and high mortality in suckling piglets (10% = norm, PRRS will increase to 50%+ for 1 – 2 months)

A3. Impacts on production – reduced fertility leading to increased culls. Immune suppression, leading to increases in respiratory and enteric problems especially.

2. Categorisation and Description of the Problem.

B1. Naïve herds, i.e. herds previously unexposed. Virus entering these herds can produce a very high mortality in suckling, growing and finishing pigs and a moderate mortality in the breeding herd, with abortions and poor fertility. Rate of spread of infection through a herd can be quite slow.

B2. Endemic Status. Immuno-suppression is the primary issue, with secondary diseases such as enzootic pneumonia, Pasteurellosis etc. and even enteric disorders, which had previously been under control, becoming of increased importance.

B3. Financial impact

- Effects on farm economics (ie deaths, secondary disease and reduced fertility)
- Decreased value of sales if a breeding unit, both internally within the UK and overseas.

C. Reservoir and Transmission of the Disease.

Infection mainly enters the herd via carrier animals, although it can also be spread by:

- Wind (from a neighbouring unit)
- Semen (most breeding units and semen sale companies now have a careful control programme to prevent transmission by semen.

D. Prevention.

Prevention is by biosecurity

D1. Prevent disease entering by purchasing certified PRRS free herds. The Industry has established a protocol of routine serological monitoring and clinical inspections to establish and confirm freedom from disease.

D2. Siting of pig Units. New units should be sited at least five miles away from existing Units.

E. Control of Infection in Endemic Herds.

E1. Both live and dead vaccines are available. If the breeding herd is vaccinated it should be possible to produce virus free weaners and to eventually suppress, if not eliminate, infection from the growers,

E2. Careful all in/all out housing is required for growing and finishing pigs, to reduce spread of virus and limit respiratory disease

E3. Incoming Stock, after a period of quarantine, should be exposed to any potential on-farm virus. This should take place after vaccination.

E4. Depopulate and replace with PRRS free stock. Many breeding companies have sources of PRRS free stock for sale, and the additional premium is not high

E5. Test and slaughter is not an option for individual pigs, because virus can easily spread from other pigs on the unit

F. Alternative Control Strategies.

None are known.

When the disease first entered the UK eradication was attempted following categorisation of PRRS as a Notifiable Disease, but this was soon dropped as being impractical. Several pharmaceutical companies now have good vaccines and control is primarily currently industry-funded. Effective vaccination against other diseases, eg enzootic pneumonia, has reduced the impact of PRRS.

Other factors contributing to the description for policy analysis

See Table 1: *strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --*

1. Endemic disease, effects on production largely *internal to the market* with impacts on output, revenue and costs of producers (--). [Note: Effects on production are explicit and tangible to producers].
2. Infection specific to pigs, but can spread from producer to producer (*third party effect*) (+)
3. Animal welfare; clinical signs cause undue suffering and distress (*negative externality*) (++)
4. Non-zoonotic (0)
5. Endemic throughout EU and other significant pig production countries, therefore no impact upon international trade (0)

Stage 3: POLICY OBJECTIVES

To encourage industry-control of PRRS

Questioning the rationale for intervention

From an economic perspective, only the protection of animal welfare provides a strong justification for government intervention.

The strong case for intervention is countered by the strong case against; the facts that the costs of the disease are primarily borne by producers and that these are explicit and tangible indicates that government *should not* intervene.

Stage 4: POSSIBLE COURSES OF ACTION/POLICY INSTRUMENTS

Externalities (++) → Command & control, Enforced self-regulation, Incentives & taxes

Command & control options: compulsory testing and vaccination, animal movement restrictions.

Enforced self-regulation: national control programmes, herd health plans, PRRS assured free herds.

Incentives and taxes options: funding support for control programmes.

The case against intervention is based upon the existing economic incentive for producers to control this disease. If the government were to intervene on the grounds of animal welfare, this should not serve to reduce the existing economic incentive.

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TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS – PRRS in PIGS: Two possible courses of action are considered below; compulsory testing and vaccination (command and control) and vaccination through voluntary agreement (enforced self-regulation).

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHV)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control														
Compulsory testing	+	+	-	++	0	++	++	+	0	+	+	++	+	-
Compulsory vaccination	+	+	-	++	-	++	++	+	0	+	+	++	0	-
Self-regulation														
Vaccination through voluntary agreement	++	+	++	++	+	++	++	+	+	0	+	++	++	+
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure														
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance														
Institutional arrangements														

Compulsory testing and vaccination

Ease of design & implementation (e.g. supported by legal framework): Would require PRRS to be made Notifiable Disease.

Ease of monitoring & enforcement: Limited number of pig holdings and availability of blood testing regimes would allow for relatively simple monitoring and enforcement.

Flexibility: Command and control options are not by nature 'flexible'.

Legitimacy, accountability, fairness, transparency: Costs of scheme could be borne by producers through an industry levy, as they will also be the beneficiaries of the scheme.

Public acceptability (media, PR, customs etc): Not in the public eye, although the pig industry may balk at being 'forced' to act. Similar industry funded schemes (eg Aujeszky's control) have worked in the past

Use & supply of technical (regulator) expertise: Considerable, in the implementation of vaccines and in serological monitoring.

Effectiveness (on AHW): Positive, given the prophylactic nature of vaccines.

Lags in impact: Medium, as vaccination programme will not necessarily eliminate infection from sow or grower units.

Market effects: Where PRRS free status is maintained without vaccination, premiums may still be sought for stock sold off-farm for breeding etc.

Public sector costs: Major costs could be borne by producers, although implementation of scheme would require input of SVS, which may be difficult to quantify and recover. .

Impact on other issues & policies: Reduction in the immunosuppressive effects of PRRS should serve to decrease prevalence and impact of other diseases. .

Scope for capture by stakeholders: The use of private sector technical expertise (veterinarians) provides considerable scope for capture.

Scope for stakeholder participation: Little scope for stakeholder participation since compulsory, although there is scope for veterinary input into monitoring frequency.

Risks & uncertainty: low – compliance guaranteed through compulsory nature of the scheme.

Vaccination under a voluntary initiative

Ease of design & implementation (e.g. supported by legal framework): No legal framework required, although an administrative system would need to be put in place. Schemes applied to cattle-health and to sheep health provide a template on which to build a PRRS Voluntary Initiative. Pig health assurance schemes are already firmly established. Costs involved in 'selling the scheme'.

Ease of monitoring & enforcement: Would require the buy-in of the majority of pig farmers and veterinarians to be successful. Best implemented on a region by region basis since the benefits of membership are dependant upon neighbouring farmers also being members. Geographical borders define the areas which can be targeted under the scheme.

Flexibility: Highly flexible, since voluntary.

Legitimacy, accountability, fairness, transparency: Costs of scheme to be borne by producers, who will also be the beneficiaries of the scheme.

Public acceptability (media, PR, customs etc): No acceptability issues.

Use & supply of technical (regulator) expertise: Considerable, in the implementation of vaccines and in monitoring.

Effectiveness (on AHW): Positive, given the prophylactic nature of vaccines.

Lags in impact: Medium, as vaccination programme will not necessarily eliminate infection from breeding and grower units and as time taken to recruit members to the scheme.

Market effects: Where PRRS free status is maintained without vaccination, premiums may still be sought for stock sold off-farm for breeding etc. Costs of vaccination would encourage more producers to become PRRS - free

Public sector costs: Major costs could be borne by producers, although implementation of scheme may require pump-priming.

Impact on other issues & policies: Reduction in the immunosuppressive effects of PRRS should serve to decrease prevalence and impact of other diseases.

Scope for capture by stakeholders: The use of private sector technical expertise (veterinarians) provides considerable scope for capture.

Scope for stakeholder participation: Stakeholder ownership of scheme critical if it is to be successful.

Risks & uncertainty: low – compliance not guaranteed and continual monitoring of uptake necessary to ensure effectiveness.

Stage 1: INDICATION OF THE ANIMAL HEALTH / WELFARE ISSUE**Sow Welfare (with specific reference to housing)****Stage 2: SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE****Veterinary description****A. Description of the issue.**

From the late 1960's dry sow housing was commonly associated with total confinement of the sow either through a sow stall, i.e. a crate that provided enough space to stand up and lie down but not enough room to turn, or alternatively sows were tethered around the neck or around the girth. This allowed them slightly greater freedom of movement and they could lie touching adjacent sows.

B. Categorisation and Description of the issue.

A ban on stalls and tethers was considered necessary for:

B1. Welfare of the sow. The total confinement led to inadequate exercise, leg problems, sometimes over grown feet, and skin sores if sows were not kept in adequate bodily condition. In addition, sows tended to lie down for long periods of time, did not urinate sufficiently frequently and cystitis was a potential – but not frequent - problem. Good levels of management were necessary to ensure removal of faecal material from the rear of the sow and thereby avoid skin soiling and ascending vaginal infections.

B2. Public perception. It was felt that the public would not consider stalls and tethers acceptable.

B3. EU legislation would eventually ban stalls and tethers.

C. Problems associated with the stalls and tether ban.

These originate largely from the inadequacy of other control options. They include:

- Bullying in group-housed systems.
- Management difficulties. For example, in large group systems it is much more difficult to identify returns in the recently served group, to identify sows in late pregnancy that require vaccination, and to identify those sows needing to be moved into farrowing accommodation.
- Vices are more prevalent, especially biting of the vulva in sows in later pregnancy. This can lead to horrific injuries. There is also an increase in leg injuries at the time of weaning, when groups of sows are mixed and manifesting oestrus.

D. Alternative housing systems.

D1. Small groups in yards. This is clearly more expensive and unless there are individual sow feeding stalls at the front of the yard, even feed allocation is difficult.

D2. Electronic sow feeders. These can work OK, but sows and especially gilts need training and there is a potential for bullying.

D3. Ad lib feeding of low energy density food. Feed costs increase, but the system is easy.

D4. Yards with trickle feeders. If feed runs in slowly it is felt that there will be less bullying.

E. Review of Current Interventions.

The UK Government decided to ban unilaterally the use of stalls and tethers in advance of the rest of the EU. Once a date was fixed, some supermarkets then tried to achieve a commercial edge over their competitors by imposing an even earlier ban on stalls and tethers.

E1. The rapid imposition of the ban, especially by the supermarkets, led to the need for rapid changes in buildings and hence many buildings were converted and were not suitable.

- E2.** Later farm assurance schemes were introduced, and by, for example, requiring boar pens of a specific size, conversions already made were in themselves illegal because of inadequate space allocations.
- E3.** There was some Government research into alternative systems, but many people in the Industry considered this inadequate and no single option was found to be ideal.
- E4.** Despite the total ban by around 1999, several countries in the EU are still using stalls and tethers. This means that the UK is now running at a significant commercial disadvantage, because alternative systems are more expensive. Despite this, it is not illegal to import pig meat and pig meat products from other countries within the EU.

Other factors contributing to the description for policy analysis

See Table 1: strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --

- 6. Animal welfare: housing can lead to welfare problems through individual confinement but also, for example, through sow-sow aggression in group sow housing (*negative externality*) (++)
- 7. Welfare effects on production largely *internal to the market* with impacts on output, revenue and costs of producers (--). However, these are not explicit and tangible to producers, and costs may not be assigned to housing, may be wrongly assigned to housing or may be unrecognised by producers.
- 8. Information lack and asymmetries with respect to good dry sow management and welfare provides reason for government intervention (+)
- 9. EU legislation now bans the use of stalls and tethers (++) , although data demonstrates that only the UK is compliant with this.

{Note: for animal welfare issues which are not directly related to production, and which do not present explicit and tangible costs to producers (e.g. the development of stereotypic behaviours in some confined sows), there is a strong argument for govt. intervention on the basis of information lack/asymmetries}.

Stage 3: POLICY OBJECTIVES

Control of dry-sow welfare.

Questioning the rationale for intervention

The protection of animal welfare provides strong justification for government intervention (++).

Stage 4: POSSIBLE COURSES OF ACTION/POLICY INSTRUMENTS

Externalities (++) → Command and control (++) , Enforced self-regulation (++) , Incentives and taxes (++) .

Information lack & asymmetries → Information, training and disclosure (++) .

Command and control: legislation concerning sow housing (e.g. ban on stalls and tethers)

Enforced self-regulation: 'welfare-friendly' practices as part of Defra welfare codes and the incorporation of these in farm assurance schemes and retailer requirements.

Incentives and taxes: 'welfare payments' to pig producers (to adopt good practice) or use of cross compliance.

Information, training and disclosure: include information campaigns to producers and mandatory or voluntary welfare labelling of pig meat (e.g. to show whether the product is from producers who have adopted the recommended pig 'welfare friendly' practice)

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TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS – SOW WELFARE

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHW)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control														
Minimum housing standards including ban on stalls and tethers	++	+	-	-	0	+	?	-	0/-	0/-	0	0	+	-
Self-regulation														
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure														
Welfare labelling (mandatory)	-	+	-/?	-/?	+/?	+	+/?	-	+/?	0/+	0/+	0	+	-
Research & promotion of sow housing management	++	+	+	+	+	+	+/?	--	+/?	-	0	0	+	-
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance														
Institutional arrangements														

Specification of minimum housing standards including ban on stalls and tethers

Ease of design & implementation (e.g. supported by legal framework): EU regulations ban stalls and tethers, and minimum standards have been in place for a long period. Development of these relatively simple.

Ease of monitoring & enforcement: Limited number of pig holdings allows for relatively simple monitoring and enforcement.

Flexibility: Command and control options are not by nature 'flexible'.

Legitimacy, accountability, fairness, transparency: Costs of scheme to be borne by producers, whilst beneficiaries are the general public.

Public acceptability (media, PR, customs etc): Publicly acceptable, although unpopular with the pig industry itself.

Use & supply of technical (regulator) expertise: Medium, in assessing the compliance of production units.

Effectiveness (on AHW): Positive, in reducing the confinement of sows, negative through increasing sow-sow aggression.

Lags in impact: Medium, changes in specifications must be introduced over a reasonable time period.

Market effects: All farms affected equally; incentives to develop market-based alternatives reduced.

Public sector costs: Major costs (e.g. of building conversions) borne by producers. Some implementation costs but low.

Impact on other issues & policies: Single-issue change with little impact upon other issues or policies.

Scope for capture by stakeholders: Some, through capital expenditure required to comply with regulations.

Scope for stakeholder participation: Little scope for stakeholder participation since compulsory.

Risks & uncertainty: additional costs resulting from minimum standards may serve to 'export the problem'.

Research & promotion of sow housing management

Ease of design & implementation (e.g. supported by legal framework): No legal framework required. Research institutions and dissemination networks already exists.

Ease of monitoring & enforcement: Monitoring and enforcement not required.

Flexibility: Highly flexible, may respond to industry needs.

Legitimacy, accountability, fairness, transparency: Costs of research and dissemination may be partially or fully borne by producers through a levy, or may be subsidised by government were animal welfare is perceived as a public good. Research ought to be legitimate, accountable and transparent.

Public acceptability (media, PR, customs etc): No acceptability issues.

Use & supply of technical (regulator) expertise: Considerable, through both the research and the dissemination phases.

Effectiveness (on AHW): Positive, provided that issues are recognised and resolved by industry.

Lags in impact: Considerable, since changes are only likely to occur when the infrastructure of pig production units is being renewed and replaced.

Market effects: Allows for the differentiation of pig products based on clear welfare differentials.

Public sector costs: Major costs could be borne by producers, although implementation of scheme may require pump-priming.

Impact on other issues & policies: Minimal.

Scope for capture by stakeholders: The use of private sector technical expertise (veterinarians) provides considerable scope for capture.

Scope for stakeholder participation: Stakeholder participation critical for the rapid adoption of management practices shown through research to be beneficial.

Risks & uncertainty: low- dependant upon appropriateness of scientific research and upon industry buy-in to succeed in improving animal welfare. In particular, high-welfare-high production systems most likely to be implemented, whereas compromises in production unlikely to be adopted as swiftly.

Mandatory welfare labelling

Ease of design and implementation would have problems for a mandatory scheme with agreement needed at EU level and problem of WTO challenge where imports involved.

Would be relatively easy to monitor providing the right accreditation system is adopted.
Flexibility would depend on the precise form of the labelling scheme.

Legitimacy of mandatory welfare labelling might be questioned both by domestic producers but particularly by exporting countries.

Public acceptability domestically likely to be positive for more product information on welfare.

Good use of technical expertise on standards.

Effectiveness on animal welfare difficult to judge and will depend on the extent to which the information is acted upon by consumers in their purchasing behaviour – but should be positive.

Could be some lag in impact while the labelling system is agreed and adopted and for consumers to react.

Market effects may be complex. Producer costs will increase but they should be able to increase sales/command some premium price for welfare label depending on consumer response. Should also aid competitiveness since current welfare friendly practices by UK producers are not differentiated for consumers compared with products produced to lower welfare standards (some of which are imported).

Public sector costs should be minimal.

Should be a positive impact on consumer choice and could help labelling for welfare for all food products (not just pig meat).

No undue capture by stakeholders.

Scope for stakeholder participation along the food chain.

Some risk/uncertainty in terms of the reaction of consumers to labelling and hence the benefits.

Stage 1: INDICATION OF THE ANIMAL HEALTH / WELFARE ISSUE**Scrapie in sheep****Stage 2: SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE****Veterinary description****A. Description of the disease.**

Scrapie is a fatal neurological disease of sheep and occasionally goats. It has been present in the national flock for over 250 years, but is not considered to be transmissible to humans. The disease develops due to changes in the Prion Protein (PrP) in the brain.

A1. Incidence - Usually occurs in sheep between 2 & 5 years of age and rarely seen in young animals or older ewes. It affects flocks in all parts of Great Britain. Usually affects individuals with no evidence of rapid spread within a flock. Stress may be a predisposing factor. No reliable statistics on what proportion of flocks are affected although on average 167 flocks per year have confirmed cases. Typically they average in total about 500 or so animals. About half of these flocks reported single cases and about half have had cases before. It is generally accepted that there is significant under reporting. Market research by Defra in 1998 showed that only about 13% of farmers that suspected they had scrapie on their farms reported it.

A2. Physical effects - Irritation, repeated rubbing and scratching, grinding teeth, becomes excitable, drooping ears, trembling, severe uncoordination (unable to stand), dramatic weight loss and death.

A3. Impact on production – minimal as only affects low numbers within any one flock.

B. Categorisation and description of the problem

Control of scrapie is necessary because of;

B1. Animal welfare. (There is no known treatment.)

B2. Potential zoonoses. Although by no means proven, there is a theoretical risk that BSE is present in sheep in the UK, masked as scrapie, although it has not been found occurring naturally.

C. Reservoir and Transmission of the Disease

It is estimated that about 25% of UK sheep breeds carry the scrapie-resistant gene and about two thirds of the national flock are at least partially scrapie resistant. Of interest New Zealand and Australia do not have scrapie although original population of sheep came from UK. Rare breeds of sheep are particularly at risk. This has caused Government some problems with their commitment to conserve and enhance biodiversity.

D. Prevention

Selection for sheep carrying the scrapie-resistant gene.

E. Control options

Scrapie is not highly contagious and control through culling and selection believed to be sufficient.

F. Review of current interventions

Clearly with all TSE's there is concern about human health. Thus much of the policy on scrapie is driven by BSE control measures on an EU wide basis. The independent SEAC committee has a key role in determining UK Government Policy, as does the FSA.

- F1. Scrapie was made a **notifiable disease** in October 1993. As no test is available which can reliably identify infected live animals, any suspect cases must be reported to the Local Animal Health Divisional Office. It is an offence under the TSE Regulations 2002, not to report even a suspect case. Penalties include a heavy fine or imprisonment. In addition scrapie compensation payments will not be made (currently £90/ewe for a confirmed case).
- F2. If clinical examination is inconclusive then a **movement restriction** is placed on the farm for up to 28 days.
- F2. The government run National Scrapie Plan (NSP) addresses the theoretical possibility of BSE being present in sheep. This **voluntary initiative** was launched in July 2001 for Great Britain. A separate scheme operates in Northern Ireland. This has had much support from the sheep industry in particular the National Sheep Association.

The objective is to eradicate scrapie from the national flock and thus reduce the theoretical possibility of BSE in sheep. This long term breeding programme of 10- 15 years will not just eliminate scrapie but will make the national flock resistant to all TSE's. There are 15 known genotypes, which determine a sheep's relative resistance or susceptibility to scrapie. The prevalence and frequency of each genotype differs between breeds. ARR/ARR combination of alleles, means that sheep are genetically most resistant to scrapie. VRQ/VRQ genotype means high susceptibility and sheep must be slaughtered or castrated.

The NSP is based on ram genotyping then micro-chipping tested rams. Each tested ram then has a certificate of proof. Originally targeted at pure bred pedigree flocks recorded via a recognized breed society, which itself has to be approved by NSA or in the cases of rare breeds the Rare Breeds Survival Trust Defra retains a list of approved breeding organisations for all species officially recognized under EU Zootechnical Legislation. NSP certified resistant rams are now realizing higher prices at some breed sales.

Scrapie eradication took a major step forward in 2004 with the introduction of both **Compulsory and Voluntary Scrapie Flock Schemes** (CSFS & VSFS). The UK implemented an EU Commission Regulation whereby flock owners with confirmed cases have to join a compulsory scheme. Here all sheep on the holding will be genotyped and complete flock can be culled. Flocks that have had a case between 1998 and 2004 are invited to join a Voluntary Scheme which has similar but less onerous rules than for the compulsory scheme.

Compensation is paid for reported scrapie suspects that are compulsorily slaughtered for diagnosis. In 2004 CSFS was implemented in 64 flocks on 38 holdings. 367 applications for 198 holdings were received for the new voluntary scheme.

In 2004/2005 £24 million has been spent on the NSP out of Defra's estimated £237 million expenditure on Animal Health and Welfare. Around 200 SVS Animal Health Officers have been trained and certified for NSP work. Cost constraints and lack of suitable SVS personnel are major issues if the long-term aims of the NSP are to be achieved.

The NSP Semen Archive has been established to store semen from rams of those genotypes that over time will be removed through Ram Genotyping Schemes. This archive should enable the re establishment of viable populations of these sheep in the future. It will also help to protect against the possible loss of beneficial breed characteristics such as hardiness. This also has implications for breeds with a tight geographical concentration. The semen archive is overseen by a joint Industry/Government Management Board who will approve the nominations of rams, which must be via breed societies. Defra have agreed to fund for 3 years from 2003. The Archive itself is owned by individual breed societies, the owner of the rams and Government.

International Trade: A Scrapie Monitoring Scheme designed to assist producers who wish to export breeding animals is in place under the NSP. Certain EU member states (Denmark/Sweden) have placed derogations that regardless of genotype UK sheep can only be exported if their flocks have not had a case of scrapie confirmed in the previous 7 years. For all

other member states and indeed elsewhere then provided breeding stock destined for export have been properly genotyped by an approved lab and have the ARR/ARR allele then there is no problem. OIE has given its approval.

Other factors contributing to the description for policy analysis

See Table 1; strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --

10. Endemic disease: occurring at 'steady' levels and with no indication of increasing rates of spread [low-risk] (--).
11. Not considered transmissible to humans [low risk] (--).
12. Usually affects individuals, with no evidence of rapid spread within a flock [low risk] (--).
13. Low incidence, typically 500 animals per year reported [low risk] (--).
14. Assuming significant under-reporting as found by Defra (1998) this represents circa 4,000 animals infected per year infected. Control, and removal of diseased sheep from the food chain, dependant upon diagnosis (*information imperfections and asymmetries*) (++)
15. Theoretical risk that scrapie is transmissible to humans. Further theoretical risk that BSE may be present in sheep, masked as scrapie and that BSE in sheep, masked as scrapie but undiagnosed, may enter the human food chain, representing a potential risk to human health (*possible zoonoses, negative externality*) (++)
16. Animal welfare; clinical signs cause undue suffering and distress (*negative externality*) (+)

Stage 3: POLICY OBJECTIVES

1. To reduce prevalence and thereby to protect human health.

Given the poor diagnosis of scrapie in the national flock, the theoretical possibility of TSEs in sheep passing to humans is being addressed through the National Scrapie Plan, the aim of which is the *reduction* and eventual *eradication* of scrapie in the national flock through a combined approach of genotyping, the registration of infected flocks and restrictions on movements of sheep from infected premises.

Questioning the rationale for intervention

Only protection of public health is a potentially strong justification for government intervention on scrapie, although this is mitigated by the low risk of transmission of BSE to sheep in the national flock (therefore + rather than ++).

Stage 4C: POSSIBLE COURSES OF ACTION/POLICY INSTRUMENTS

(see table 2)

Externalities (++) → Command and control (++) , Enforced self-regulation (++) , Incentives & taxes (++)

Information inadequacies (++) → Information, training and disclosure.

Command and control options: compulsory genotype testing (as a proxy for diagnosis) of flocks in which scrapie diagnosed/ compulsory testing of all flocks, animal movement restrictions.

Enforced self-regulation: national control programmes encouraging registration of susceptible and non-susceptible flocks.

Incentives and taxes: funding support for control programmes.

Information inadequacies: information campaigns to assist diagnosis and prevention and mandatory disclosure of incidence.

Compulsory genotype testing of flocks reporting cases of scrapie may fail to address the predominant under-reporting of the disease, addressing only those flocks where reporting is already taking place. Imposition of movement controls / restrictions on sales presents a disincentive to reporting and may exacerbate under-reporting. The low probability of infected stock transmitting the disease to humans and the difficulties in diagnosing scrapie in the field shift the balance against any disincentives to reporting, and towards compensation for culled stock and the support of a market for scrapie-free accredited stock.

Registration of non-susceptible (or low-susceptible) flocks provides a financial incentive for industry-administered testing regime through the creation of a market for scrapie-free accredited stock. This may be through enforced self-regulation, if necessary with central government support.

Under reporting may be due to either a) lack of knowledge in farmers or b) disincentives (see above). Information campaigns may be necessary to overcome this under-reporting, particularly if combined with a positive incentive towards scrapie-free accreditation.

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TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS – SCRAPIE IN SHEEP

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHW)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control														
Compulsory genotype testing of infected flocks	-	--	-	++	++	++	+	-	-	--	0	0	0	-
Self-regulation														
Voluntary registration of susceptible/ non-susceptible flocks	+	+	+	+	+	++	+	--	+	-	+	0	++	-
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure														
Information campaigns (diagnosis)	++	+	+	+	+	+	+/-	+	+	-	+	-	+	-
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance														

Institutional arrangements														
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Stage 1: INDICATION OF THE ANIMAL HEALTH / WELFARE ISSUE**Rabies in companion animals****Stage 2: SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE****Veterinary description****A. Description of the Disease.**

Rabies is a viral infection of a wide range of mammals, including man. Following the onset of clinical signs it is invariably fatal. The virus is transmitted through the bite of an infected animal and following a variable incubation period (for dogs and cats this is normally between 2 and 6 weeks, but may be as long as 6 months) causes acute encephalitis. Urban rabies (dog as the principal host and vector) occurs mostly in less developed countries and causes the majority of human rabies deaths worldwide. Wildlife rabies (wild carnivores as the principal host and vector) allows fewer opportunities for spill-over into the human population although domestic animals may still be exposed.

A1. Incidence Data collated by the WHO Collaborating Centre for Rabies Surveillance and Research indicates that incidence in wildlife and domestic animal vectors in the European Union is very low whilst the incidence in both of these groups within the Accession States and within former Soviet Union remains considerably higher. In the second quarter of 2005 there were 2159 recorded cases across the whole of the European continent, including 1222 cases in wild animals (principally foxes), 926 in domestic animals, 7 in bats and 4 in humans.

A2. Physical effects Following the onset of clinical signs, death follows within a matter of days.

B. Categorisation and Description of the Problem.

Control of rabies is necessary because of:

B1. Animal welfare. There is no known treatment for the disease. Death by rabies involves considerable suffering and distress.

B2. Zoonosis.

B3. Speed of transmission. The nature of the host species allows for a rapid return of the disease, and there is therefore a need for continual monitoring and control.

C. Reservoir and Transmission of the Disease. Small carnivores are the main reservoir for the disease, characterised by their high population densities and potentially high population growth rates. The virus is highly pathogenic for the reservoir host species, whilst infection of non-reservoir species requires a large infectious dose. Oral vaccination of the red fox in the European Union (previously the principal wild carnivore host) has dramatically reduced the number of cases from around 12,000 per year in 1980 to less than 100 in 2001.

The major route of transmission is saliva, following the bite of an infected animal, and through the contamination of open wounds.

D. Prevention. Prevention of introduction (UK) through quarantine and the Pet Travel Scheme (PETS). Prevention is enhanced through pan-European efforts to reduce the incidence within wildlife and domestic animal hosts, thus reducing the proximity of wild and domestic animal reservoirs of the disease.

The six month quarantine period continues for any animal not compliant with the Pet Travel Scheme. However, the PETS allows the movement of dogs, cats, ferrets, domestic rabbits and rodents from qualifying countries into the UK. Five stages apply;

- identification
- vaccination
- blood test
- documentation (passport)

- tick and tapeworm treatment

E. Control Options. There are a range of control options available in the case of an outbreak, set out in the Rabies (Control) Order 1974. These may be summarised as;

- E1.** Rapid identification and destruction of infected animals.
- E2.** Compulsory vaccination of at-risk domestic animals.
- E3.** Animal movement controls.
- E4.** Control of wildlife species.

F. Review of Current Interventions.

- F1.** The introduction of PETS has required Government investment, justified through the control of rabies as a public health risk. The government does not charge for certificates, and bears the costs of passport administration. However, many of the other costs are borne directly or indirectly by the pet-owners (e.g. micro-chipping, vaccination, checks by carriers).
- F2.** Whilst many of the countries and territories eligible for PETS are rabies-free or maintain very low incidences of the disease, others (e.g. Lithuania, Latvia, Estonia and the Russian Federation) pose a more significant threat, although there is no differentiation between these in terms of restrictions or monitoring.
- F3.** A voluntary reporting scheme (DACTARI) has been established to monitor the incidence of exotic diseases (*Leishmaniasis*, *Babesiosis*, *Ehrlichiosis*) in pets which have travelled abroad either under PETS or returning through a period in quarantine. Thirty three cases were presented over 2003/04. Over 60,000 animals entered the UK under PETS in 2004, although other than for rabies there is no routine testing for diseases and there is no record of where travelled animals now reside. Information from the Universities of Bristol and Liverpool indicate higher incidences for example of *Leishmaniasis* in animals which have travelled abroad.
- F4.** The introduction of PETS has led to the development of insurance services for animals travelling overseas. For example, Kennel Club Insurance covers overseas travel provided that all facets of the PETS are complied with.

Other factors contributing to the description for policy analysis

see Table 1; strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --

1. Exotic disease: eradicated from much of continental Europe [low-risk] (--).
2. Infection of non-reservoir species requires large infectious dose [low risk] (-)
3. However, the nature of the host species allows for the rapid return and spread of the disease [high risk] (++)
4. The growth in the population of urban foxes presents a growing challenge to the distinction between urban and wildlife vectors [high risk] (++)
5. Maintenance of rabies-free state within wildlife (fox) vector and urban (dog) vectors prevents wide-scale incidence in wild and domestic animals and reduces likelihood of infection of humans (*public good*) (++)
6. Reservoir in European continent is predominantly within the wildlife vector, i.e. *external to the (domestic animal) market* (+)
7. Zoonosis (*negative externality*): infection through contact with diseased animals leads to acute encephalitis and death (++)
8. Animal welfare; clinical signs within wild and domestic animals cause undue suffering and distress (*negative externality*) (++)
9. Differences across EU states in the opportunities to travel with pet dogs (social goals; *co-ordination of markets*) (+)

Stage 3: POLICY OBJECTIVES

1. Maintenance of rabies-free status
2. Protection of public health
3. Rationalisation of travel within the EU

Questioning the rationale for intervention

The protection of public health and of animal welfare provide a strong case for government intervention on rabies. However, within a rabies-free state, there is no public health and animal welfare justification for further government intervention over and above the maintenance of that state.

Stage 4: POSSIBLE COURSES OF ACTION/POLICY INSTRUMENTS

Externalities and public goods (++) → Command & control, Enforced self-regulation, Incentives & taxes, and Direct action (+/++).

Social goals (+) → Direct action (++)

Command & control options: Border controls, restrictions and licensing of animal movements, technical specifications of vaccinations and treatment of animals moving in or out of the country. Where animals are moving between rabies-free states, such controls are theoretically unnecessary.

Enforced self-regulation options: Registration of dogs and cats in order that actions in the event of an outbreak may be most effectively targeted and in order that the risks of spread in the domestic and wildlife vectors may be properly assessed, and vaccination administered.

Incentives & taxes options: Reduced insurance premiums for animals certified as not travelling to at-risk (not rabies-free) countries.

Direct action options: Vaccination of wildlife vectors, SVS identification and culling of infected animals.

Note:

Whilst the control of rabies is the primary concern of the Pet Travel Scheme, increased mobility of the pet population and exposure to exotic diseases other than rabies presents a different and perhaps greater risk to the UK population of domestic animals. Assuming that these are non-zoonoses, there is therefore a current impact which is a) internal to the domestic animal market (--) but through disease spread may have a third party effect (negative externality) (+) and present animal welfare impacts (+ or ++ depending upon the disease and its severity and spread). Information asymmetries provide some reason for intervention (+).

The voluntary reporting scheme (DACTARI) provides a means by which veterinarians may implement monitoring of animals presented with some such exotic diseases. However, for more contagious or newly emerging exotic diseases the negative externality of disease spread might be assigned (++) and the animal welfare impacts similarly assigned (++) , implying that there is a need for a post-border control mechanism to intervene in the monitoring and control of exotic diseases.

1. Externalities (++) → Command & control, Enforced self-regulation & Incentives & taxes.
2. Information asymmetries → information, training and disclosure (++)

Command and control options: limited once animals have returned to the UK / are out of quarantine. Additional post-return testing of animals for exotic diseases may be integrated into the pet passport scheme.

Enforced self-regulation options: registration of domestic cats and dogs (as above) would ensure that actions in the events of an outbreak of an exotic disease could be most swiftly dealt with and would highlight at-risk animals in the event of non-compliance with command and control options.

Incentives and taxes options: voluntary registration or additional veterinary health checks may be tied-in with reduced insurance premiums. For those opting not to insure their pets, alternative means of incentivising registration or additional health checks might include direct funding (subsidy). If 100% coverage of registration/veterinary treatment is necessary then incentives may not be sufficient, in which case command and control / enforced self-regulation must be applied.

Information asymmetries options: public information campaigns through veterinary practices, animal ownership societies and animal welfare charities.

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TABLE 4: ATTRIBUTES of ALTERNATIVE REGULATORY INSTRUMENTS – RABIES IN COMPANION ANIMALS

	Ease of design & implementation (e.g. supported by legal framework)	Ease of monitoring & enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc)	Use & supply of technical (regulator) expertise	Effectiveness (on AHW)	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risks & uncertainty
Command & control														
Border controls inc. Pet Travel Scheme	+	+	--	++	+	++	+	+	0	++	--	++	++	-
Self-regulation														
Registration of cats and dogs	-	+	--	++	+	0	++	+	0	+	++	0	0	0
Incentives & taxes														
Promoting competitive markets														
-Franchising & licensing														
-Contracting														
-Tradable permits and quotas														
Information, training & disclosure														
Direct action and public ownership														
Rights & Liabilities: laws														
Public compensation/ insurance														
Institutional arrangements														

Border controls – the Pet Travel Scheme

Ease of design & implementation (e.g. supported by legal framework): PETS and quarantine both established and supported.

Ease of monitoring & enforcement: Due to limited entry points to the UK, monitoring and enforcement simplified. However, considerable effort is needed to maintain high levels.

Flexibility: Command and control options are not by nature 'flexible'.

Legitimacy, accountability, fairness, transparency: Costs of passports and of many border-checks borne for the most part by those using the system. Framework and oversight costs borne by the taxpayer.

Public acceptability (media, PR, customs etc): Moving from a position of quarantine as the only option, PETS has been welcomed by many groups.

Use & supply of technical (regulator) expertise: Considerable, in the implementation of vaccines for example.

Effectiveness (on AHW): Necessity between EU member states demonstrating rabies-free or virtually rabies-free status is questionable. Negative impact of long-term quarantine on welfare of some pets.

Lags in impact: Immediate.

Market effects: No clear effects on the pet or travel industry.

Public sector costs: Implementation of border controls incurs considerable public sector costs.

Impact on other issues & policies: Control of limited number of diseases (1 – rabies) ignores risks from other exotic diseases.

Scope for capture by stakeholders: The use of private sector technical expertise (veterinarians) provides considerable scope for capture. Additionally, the increased level of overseas travel provides scope for the insurance industry to create and capture an additional income stream.

Scope for stakeholder participation: above and beyond compliance with the Pet Travel Scheme there is little scope for stakeholders to be involved in the ongoing administration of the Scheme.

Risks & uncertainty: vaccination failure and forged documentation present risks to this system being effective. However, given the very low incidence of rabies in the domestic vectors of most participating countries within the Pet Travel Scheme, the likelihood of these leading to a disease outbreak remains low.

Registration of cats and dogs

Ease of design & implementation (e.g. supported by legal framework): A return to licensing may require legislation and would certainly require negotiation at the EU level in order that non-registered, non-UK animals would be able to enter the country (e.g. through being registered in their own country).

Ease of monitoring & enforcement: Current dog-warden system would benefit from compulsory identification and registration of animals. Systems designed for Pet Travel Scheme and British Cattle Movement Service are already in place.

Flexibility: Command and control options are not by nature 'flexible'.

Legitimacy, accountability, fairness, transparency: Costs may be borne by pet-owners and principle benefits gained by same owners.

Public acceptability (media, PR, customs etc): Many animal welfare charities and veterinarians have previously called for registration. Unlikely to meet with strong institutional objections.

Use & supply of technical (regulator) expertise: Little use, since a bureaucratic rather than a technical means of disease control.

Effectiveness (on AHW): Registration will allow for targeted monitoring and control of disease outbreaks, including targeted vaccination, presenting a positive impact on animal welfare.

Lags in impact: Implementing a registration scheme, outside of an emergency situation, will involve considerable consultation and implementation time, presenting a significant lag in impact. Once implemented, registration will allow a more rapid response to disease outbreaks.

Market effects: Trade in companion animals demands a premium only for those animals which are pedigree and therefore already registered within a central organisation, or for working animals which are of known provenance. There are therefore no foreseen market effects.

Public sector costs: Whilst establishing a registration system will demand public sector costs, previous initiatives (Pet and Cattle passports, in particular) provide a platform to build upon. Once established, costs may be borne or at the least supplemented by pet-owners through a registration fee.

Impact on other issues & policies: Registration will allow for the monitoring and control of a wide range of diseases of companion animals, providing a positive impact.

Scope for capture by stakeholders: Evidence from the British Cattle Movement Scheme indicates that there will be some capture by stakeholders e.g. with veterinarians recording changes in registrations on their clients' behalf. Data protection may prevent individual's details from being released from the registration, but the more general data collected by the registration system will be of value to the broad scope of the 'pet industry'.

Scope for stakeholder participation: Other than in the establishment of the registration scheme, there is little scope for stakeholders to be involved in the ongoing administration of the scheme.

Risks & uncertainty: As a monitoring tool to support disease control, registration presents no risks.

Stage 1: THE NEED FOR DECISION MAKING

Foot & Mouth Disease

Stage 2: VETERINARY SPECIFICATION OF THE ANIMAL HEALTH AND WELFARE ISSUE**A. Description of the Disease.**

FMD is a highly infectious viral disease, which can spread very rapidly between cloven-hoofed animals (cattle, pigs, sheep and goats). The incubation period can be as little as two days, i.e. two days between exposure to the virus and clinical signs being seen, and as long as 20 days. The length of the incubation period together with the absence of clinical signs in sheep allows the disease to spread over a large area before it is recognised and diagnosed. Infected pigs, in particular, excrete large numbers of virus particles. The virus can survive in the environment for up to 30 days in the winter, but only 3-5 days in the summer.

A1. Incidence – FMD was once common in the UK, with outbreaks occurring roughly annually until the end of the 1960's. Since then there have only been two outbreaks, a single isolated and predicted case in the Isle of Wight in 1981, and a major national outbreak in 2001.

A2. Physical effects – Large blisters develop on the tongue and within the mouth, leading to drooling and an inability to eat. Blisters on the teats, in dairy animals, lead to extreme discomfort and make them almost impossible to milk. Blisters on the feet lead to lameness. Heart lesions in young stock can produce mortality of up to 50% in young animals.

A3. Impact on production – The combination of these effects leads to a dramatic decline in production, body weight and an increase in mortality.

B. Categorisation and Description of the Problem.

Control of FMD is necessary because of:

B1. Financial impacts – due to clinical effects on production described above.

B2. Animal welfare. Animals suffer pain and distress while there is no known treatment.

B3. International trade. If the UK were endemically infected with FMD it would limit severely our potential for export of live animals and milk and meat products.

B4. International commitments. The legal basis for the control of FMD across the EU is covered by the Council Directive 2003/85/EC adopted in September 2003. The UK is also committed, as a member of the OIE, to reporting and controlling outbreaks of FMD.

C. Reservoir and Transmission of the Disease.

Potential routes of entry of infection to the UK are legal or illegal cross border entry of infected;

- live animals
- meat products
- milk and dairy products

or international transfer by airborne virus

The major routes of transmission are:

- animal to animal contact
- faecal contact
- infected milk
- contaminated objects (e.g. vehicles, clothing).
- airborne virus

D. Prevention and precautionary strategies

Measures for the prevention of disease entry include:

- border controls

Precautionary measures include:

- strengthening and improving traceability and surveillance mechanisms
- improved bio security on farms and general education and awareness in the farming community
- animal movement control regimes
- contingency planning for future outbreaks
- Note that the use of prophylactic (routine) vaccination is banned throughout the EU.

E. Control Options.

There are a range of control options following infection.

- E1.** Rapid identification and immediate slaughter of infected animals (with payment of compensation)
- E2.** Dangerous contacts traced and slaughtered (with compensation)_
- E3.** Pre-emptive or 'firebreak' culling of animals not on infected premises
- E4.** Movement controls on animals, people and vehicles
- E5.** Increased levels of bio security, cleansing and disinfection in the vicinity of infected premises and beyond.
- E6.** Emergency vaccination, with the aim of allowing animals to live after vaccination or, alternatively, just to allow for delays in the slaughter and disposal of carcasses.

F. Review of Current Interventions.

- F1.** A detailed Foot and Mouth Contingency Plan has been prepared and is now incorporated in the Exotic Animal Disease Generic Contingency Plan (Defra 2005).
- F2.** Border controls have been strengthened by (i) the prohibition of imports of meat, milk and their products from non-EU countries, for personal use, (ii) development of systems for awareness of outbreaks in other countries and (iii) strengthening anti-smuggling activities and penalties for infringement
- F3.** Encouragement of improved bio security on farms through general education and awareness in the farming community
- F4.** Traceability and surveillance mechanisms have been strengthened, together with continuation of the 6-day animal movement control regime.
- F5.** The contingency plan includes definitions of different 'states of alert', and prescribes the administrative and organisational structures, human and material resource availability, financial control, management and communications to be employed in the event of an outbreak.
- F6.** Diseased and susceptible animals on infected premises will be culled (with a target of within 24 hours of report). Animals identified as dangerous contacts will also be culled (within a target of 48 hours)
- F7.** A Protection Zone will be imposed with a minimum radius of 3 km around the Infected Premises, and an outer Surveillance Zone with a minimum radius of 10 km. In both zones improved bio security and hygiene is required while movements of animals, products, feeds and bedding are prohibited except under licence, and animal products must be treated to destroy the FMD virus. Within the Protection Zone, only, no animal movements are allowed except for movement to emergency slaughter, while public footpaths will be closed.
- F8.** Carcass disposal will be by incineration, with rendering as the next option.
- F9.** Emergency vaccination will be considered as an option, on the basis of vaccination to live where possible.

F10. Pre-emptive or 'firebreak' culling of animals not on infected premises and not classed as dangerous contacts, may be used, if thought appropriate.

Other factors contributing to the description for policy analysis

See Table 1: strong case for ++, reasonable case for +, no effect 0, reasonable case against -, strong case against --

1. Production losses due to the disease are private costs, internal to the market (- -).
2. In so far as there may be public concerns regarding the impact of the disease on animal welfare, this represents an external cost (+).
3. However, the risk of disease spread to other premises represents a serious externality. These external risk costs are also experienced by producers in other countries.
4. The expected level of these costs, together with the resultant loss of export markets⁸, are seen as justifying measures for the control and eradication of Foot and Mouth Disease.
5. Following eradication, control measures are needed to limit the occurrence and spread of new outbreaks and thereby to maintain disease free status (externalities & public goods) (++)

Stage 3: POLICY OBJECTIVES:

1. To limit the probability (risk) of disease entry.
2. To limit the extent and cost of possible future outbreaks
 - a. by precautionary control measures to prevent entry
 - b. improved contingency planning for the management of future outbreaks
3. Cost sharing with the industry.

Questioning the rationale for intervention

The significant third party effects (externalities, ++) relating to disease spread between species and the maintenance of export markets (public (toll) goods, ++), together with the protection of animal welfare, provide strong justification for government intervention (++)

Stage 4: POSSIBLE COURSES OF ACTION

In the case of Foot and Mouth Disease policy decision making has reached an advanced stage. In effect policy choices have been made and implemented (Stage 8). None the less it may be useful to consider the institutional framework for two key policy instruments, border controls and compulsory culling of animals with compensation, both of which involve 'command and control'.

Externalities (++) → Command & control, Enforced self-regulation, Incentives & taxes (++) , Public compensation/Social insurance (+)

Public goods (++) → Command & control, Enforced self-regulation, Incentives & taxes, Direct action and Institutional arrangements (++)

Command & control options: border controls, animal movement restrictions, compulsory testing & vaccination, compulsory culling,

Enforced self-regulation options: national control programmes, bio-security incorporated into herd-health (inc. vaccination) plans, assured free status.

Incentives and taxes options: linking subsidy levels to bio-security standards, or imposing heavy fines for failure to achieve basic bio-security standards.

Direct action options: contingency planning by central and local authorities

Institutional arrangements: State Veterinary Service preparedness training and surveillance.

⁸ The cost of losing export markets may have been overstated a) because UK is a net importer of beef, lamb and pigmeat b) because some studies have shown that the price differential between FMD free markets and FMD endemic markets is lower than expected (Jarvis, Cancino & Bervejillo 2005).

Public compensation⁹ / Social insurance options: Compensation of owners for culled livestock.

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⁹ In connection with stamping-out policies, it is normal practice to compensate livestock owners for the value of animals culled, for disease control purposes. Accurate valuation is important, to avoid over-generous compensation rates, which result in excessive cost and provide an incentive to have animals declared as infected or in dangerous contact. This problem contributed to the huge economic costs of the FMD outbreak in 2001 (Comptroller and Auditor General 2002). Valuation must be completed as swiftly as possible needed to avoid delay in the slaughter and disposal of animals to be culled. Standardisation of payments per animal, other than of pedigree breeding stock, and of hourly payments to valuers, may facilitate and speed the process but the primary legislation has not yet been amended to allow these changes in the case of FMD.

Compensation may also be paid for animals culled voluntarily for welfare reasons (In 2001, 3.1 million animals were culled for welfare reasons, compared with just over 4 million slaughtered for disease control). Again payments above the current market prices provide "incentives to farmers to let their livestock become welfare problems" (Comptroller and Auditor General *op cit*). The case for compensation for animals slaughtered voluntarily for welfare reasons is less strong than that for animals slaughtered under compulsion. Producers are rarely compensated for other consequential losses, such as those caused by movement standstill or export bans.

TABLE n. MATRIX: Evaluation of alternative regulatory instruments (Border controls)

	Ease of design & implementation	Ease of monitor-ing and enforcement	Flexibility	Legitim-acy, accountability fairness transparency	Public accept-ability (media, PR, customs etc.)	Use & supply of technical regulator expertise	Effectiveness on AH&W	Lags in impact	Market effects	Public sector costs	Impact on other issues and policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risk mgmt.
Border controls (import bans): Command & control	+	+	--	+	+	+	++	++	-	-	-	--	-	++
Self regulation														
Incentives														
Promoting competitive markets														
Franchising														
Contracting														
Tradable permits?														
Disclosure														
Direct action														
Rights /laws														
Public compensation/ insurance														
Institutional arrangements														

Border controls (import bans): Command and control

Controls are specific and should be easy to design, but implementation may be disputed under the SPS Agreement of WTO

Monitoring & enforcement easy for legal trade, smuggling, or accidental-entry may be more difficult to control

Quantity controls/bans are totally inflexible

Clear, transparent method of preventing disease entry

Public acceptability likely to be high except where applied to a particular desired product from a specific source

Decision to control imports based on technical (regulator) advice

Effective in helping to protect animal health and welfare

Immediate impact, no lags

Border controls may have adverse impact on the market

Public sector may face some costs of enforcement

May have adverse impact on other issues and policies for trade

There is scope for capture by stakeholders in that domestic producers might encourage import bans to reduce competition in domestic markets

There is no scope for stakeholder participation in implementation

Import bans are very effective in limiting risk of disease entry

TABLE n+1. MATRIX: Evaluation of alternative regulatory instruments (Compulsory slaughter & compensation)

	Ease of design & implementation	Ease of monitoring and enforcement	Flexibility	Legitimacy, accountability, fairness, transparency	Public acceptability (media, PR, customs etc.)	Use & supply of technical regulator expertise	Effectiveness on AH&W	Lags in impact	Market effects	Public sector costs	Impact on other issues & policies	Scope for capture by stakeholders	Scope for stakeholder participation	Risk mgmt.
Compulsory Slaughter: Command & control	+	++	--	-	0	+	++	++	-	--	--		-	+
Self regulation														
Incentives														
Promoting competitive markets														
Franchising														
Contracting														
Tradable permits?														
Disclosure														
Direct action														
Rights /laws														
Compensation for culled stock: Public compensation/ insurance	+	--	-	0	0	+	0	-	0	--	+/-	-	++	+
Institutional arrangements														

Command and control option: Compulsory slaughter

Rules for identifying animals for slaughter relatively easy to design

Rules for slaughter have the force of law. Easy to monitor and enforce

Command and control is necessarily inflexible

Legitimacy, accountability, fairness and transparency are reasonably good given that culling of diseased and at risk animals clearly reduces disease spread

Public acceptability mixed: benefits of disease control set against objections to animal slaughter and methods of carcass disposal

Technical (regulator) expertise is clearly involved in identifying animals for culling

Beneficial effects in limiting animal disease and reducing animal welfare loss

Takes immediate effect, limited lags on impact

Negative impact on market as supply of livestock reduced

Public sector faces high costs of implementation

Disposal of carcasses has adverse effect on other issues and policies, particularly environmental

There is little scope for a compulsory slaughter strategy to be captured by producers, given that it imposes costs

There is very little scope for producer participation in a command and control policy

Compulsory slaughter limits risk of disease spread, while risks of failure are small.

Public compensation/insurance: Compensation paid for culled stock

Fairly easy to design and implement, provided satisfactory valuation procedures can be arranged

There may be problems of monitoring and enforcing the levels of payment made (preventing over-payment)

The system is largely standardised and inflexible

Legitimacy, accountability, fairness and transparency may be satisfactory where compensation is thought to be justified, but this may not be the case where over-payment occurs

Public acceptability satisfactory where compensation is thought to be justified, but this may not be the case where over-payment occurs

Good use is made of technical (regulator) expertise in organising valuation and payment systems

No additional impact on animal health and welfare

Lags in impact may occur, depending upon how quickly the valuations and the necessary paperwork can be completed

No market effects expected

Under this system costs are wholly borne by the public sector

Has an impact on other issues and policies, such as the private provision of livestock insurance and compensation for other farmer losses

There may be scope for capture by stakeholders in claiming and receiving excessive payments

The only participation by producer/stakeholders is in lodging claims

Risks of objections to the slaughter policy are reduced by paying compensation