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**Cost-Benefit Analysis with Applications to
Animal Health Programmes: Valuation of Non-
Market Costs and Benefits**

by

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'The overall goal of this project is to develop and evaluate the necessary tools to provide decision-makers with reliable animal health information which is placed in context and analysed appropriately in both Thailand and Australia. This goal will be achieved by improving laboratory diagnostic procedures; undertaking research to obtain cost-effective population referenced data; integrating data sets using modern information management technology, namely a Geographical Information System (GIS); and providing a framework for the economic evaluation of the impact of animal diseases and their control.

A number of important diseases will be targeted in the project to test the systems being developed. In Thailand, the focus will be on smallholder livestock systems. In Australia, research will be directed at the northern beef industry as animal health information for this sector of livestock production is presently scarce.'

For more information on *Research Papers and Reports Animal Health Economics* write to Professor Clem Tisdell (c.tisdell@economics.uq.edu.au) or Dr Steve Harrison, (s.harrison@uq.edu.au) Department of Economics, University of Queensland, Brisbane, Australia, 4072.

This is number five of a set of six papers by Dr. S. Harrison on *Cost-Benefit Analysis with Applications to Animal Health Programmes* to be published in this series Research Papers and Reports in Animal Health Economics.

Papers in this Set

1. Cost-Benefit with applications to Animal Health Programmes: Basics of CBA, Research Paper or Report No. 18.
2. Cost-Benefit Analysis with Applications to Animal Health Programmes: Complexities of CBA, Research Paper or Report No. 19.
3. Cost-Benefit Analysis with Applications to Animal Health Programmes: Spreadsheet Implementation of Discounted Cash Flow and Risk Analysis, Research Paper or Report No. 20.
4. Cost-Benefit Analysis with Applications to Animal Health Programmes: Allowing for Project Risk in CBA, Research Paper or Report No. 21.
5. Cost-Benefit analysis with applications to Animal Health Programmes: Valuation of Non-Market Costs and Benefits, Research Paper or Report No.22.
6. Cost-Benefit Analysis with Applications to Animal Health Programmes: Animal Health Programmes and Information Systems, Research Paper or Report No.23.

Cost-Benefit Analysis with Applications to Animal Health Programmes: Valuation of Non-Market Costs and Benefits

ABSTRACT

This discussion paper is designed to provide an introduction to the various methods of valuing so-called 'non-market goods' for economic analysis of animal health programs. The concept of non-market values is examined, with examples in relation to animal health. Various techniques for estimation of these values are discussed, and the contingent valuation method is examined in detail. Finally, some comments are made about various issues associated with the use of these techniques.

Keywords: Animal health programs, risk and uncertainty,

JEL Classification: Q16, D81

Cost-Benefit Analysis with Applications to Animal Health Programmes: Valuation of Non-Market Costs and Benefits

1. INTRODUCTION

Any major government program tends to have a number of impacts which are not reflected by price changes in markets. This occurs on both the cost and benefit side. Economic analysis to guide animal health policy needs to take into account not only production and trade effects but also broader socio-economic and environmental impacts.

In early applications of cost-benefit analysis (CBA) in the 1960s and 1970s, many of the economic impacts of projects were considered too difficult to place values upon, and were treated as *intangibles*. With the growth of the environmental movement came recognition of the importance of benefits and costs which traditionally were not taken into account in economic analysis. During the 1980s in particular, considerable progress was made in development of methods for valuing difficult-to-estimate costs and benefits, including those items for which values cannot be observed through market transactions, i.e. non-market costs and benefits. The emphasis has been on items such as environmental and conservation benefits, quality of life, food self-sufficiency and security and impacts on human health and community peace of mind.

Nowadays, a variety of non-market benefits and costs are often factored into CBA, to rank equally with market benefits and costs. This gives rise to what is sometimes referred to as 'extended' or 'social' cost-benefit analysis. The technique of CBA has undergone a major resurgence in recent times, in part due to the requirement for greater economic responsibility in government in a time of tight finances and increasing belief in market mechanisms, but also in part due to increased skills of economists in placing estimates on a wide range of benefit and cost items.

This discussion paper is designed to provide an introduction to the various methods of valuing so-called 'non-market goods' for economic analysis of animal health programs. The concept of non-market values is examined, with examples in relation to animal health. Various techniques for estimation of these values are discussed, and the contingent valuation method is examined in detail. Finally, some comments are made about various issues

associated with the use of these techniques.

2. NON-MARKET VALUES AND VALUATION METHODS

Market values are values of goods and services arising from transactions between buyers and sellers in markets. Typical livestock markets are saleyard auctions, direct sales to meatworks, in-paddock sales and production under contract. Values obtained in these markets can be observed or recorded, and are sometimes referred to as *revealed preferences*. Values of market goods arising from animal health programs - such as increased meat production, increased farm receipts or reduced production costs - can usually be estimated with an acceptable degree of precision. On the other hand, many goods and impacts in general which we would regard as important are not traded in markets; these are *non-market goods*. An example would be the value a livestock owner places on having healthy and high quality stock, apart from any extra productivity which this provides.

While some non-market benefits and costs impact directly on producers, others have wider impacts. As an example, if a producer did not take adequate vaccination and other disease control measures, the disease risk in neighbouring properties could increase. In economic language, we say that as producers attempt to maximise their *private benefits*, they cause *externalities* or spillover effects for society. Externalities are usually difficult to value, and often take the form of non-market costs and benefits. While externalities are often negative, including many environmental impacts of rural industries, the externalities of animal health measures are overwhelmingly positive. This is the reason why governments usually provide support for animal health programs.

Economists are faced with the task of estimating how important these externalities are, to assist in formulating policies for efficient, equitable and sustainable production systems. To achieve this, they need to work closely with scientists to understand and model animal production systems. While there is an obvious temptation to focus on direct production benefits, their role in providing decision support will be limited if they treat social, environmental and other non-market impacts as intangibles which can be noted but are beyond the scope or measurement in dollar terms.

Non-market values can form an important component of the benefits and costs of public sector programs and policies. They can be highly important at a regional economy or

individual firm level. Often market and non-market impacts can't be clearly differentiated, and there is little purpose in trying to keep them separate. The important issues it to identify all the significant socio-economic and environmental impacts of animal health programs, to factor them into the economic analysis where possible, and to note their relative importance when estimation is impractical.

Another reason for interest in non-market valuation is that they may be the most workable approach to valuation with respect to market goods. For example, in estimating the production benefits of improved health in say meat cattle, weight changes could be recorded over time for samples or cases of disease-affected and disease-free animals. But a more rapid and not necessarily less reliable approach would be to elicit a consensus view from a panel of 'experts', including veterinary officers and animal production researchers. Many of the non-market valuation methods depend on opinion surveys and analysis of previous research results. These approaches can provide quicker and lower-cost estimates which may be essential for CBA.

3. EXAMPLES OF INDIRECT AND NON-MARKET COSTS AND BENEFITS

While non-market costs and benefits have typically been considered in the context of environmental management, nevertheless there are a number of aspects of animal health programs where they become relevant. Some of these are listed in Box 1.

Box 1: Some potential non-market impacts of improved animal health

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| IMPROVED COMMUNITY NUTRITION AND HEALTH ADDITIONAL EMPLOYMENT IN LIVESTOCK INDUSTRIES GREATER ECONOMIC SELF-RELIANCE OF LIVESTOCK PRODUCERS IMPROVED COMMUNITY INCOME DISTRIBUTION ENVIRONMENTAL IMPACTS OF EXPANDED INTENSIVE PRODUCTION INCREASED GRAZING PRESSURE AND PASTURE DEGRADATION RESIDUES OF VETERINARY PRODUCTS IN MEAT AND MILK REDUCED PRODUCER ANXIETY OVER SICK ANIMALS GREATER PRODUCER SATISFACTION WITH STOCK QUALITY IMPROVED ANIMAL WELFARE INCREASED RECREATION VALUE OF LIVESTOCK |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The justification for livestock disease eradication programs is often the threat these diseases pose to human health, e.g. examples being campaigns against bovine tuberculosis and brucellosis. As well, there are many livestock diseases which have a lesser but still detectable impact on human health, particularly for those people working closely with the animals. These include food-and-mouth-disease (FMD) in cattle and pigs and Newcastle Disease in poultry (Steele, 1992). Human health benefits of control programs for livestock diseases are difficult to measure, and typically involve non-market valuation methods. Animal health also has a relationship with human nutrition, since livestock products are an important source of dietary protein and minerals. Overcoming disease obstacles to successful dairy production can be significant for child health.

Disease control can provide increased income and self-sufficiency for what is often a low income section of the population, with consequent savings in income support. Healthy animals provide an emergency food reserve, store of wealth, an asset against which to secure credit, fuel and fertiliser. Control over livestock diseases is an important precursor to expansion and modernisation of livestock industries (Harrison and Tisdell, 1995). However, by giving rise to higher reproduction rates, animal health programs can increase livestock grazing pressure and expansion of intensive livestock production systems, which in turn can have adverse environmental impacts (e.g. Tisdell and Harrison, 1995). For example, expansion of intensive piggeries can create additional noise and odour problems for neighbours and passers-by, and unwanted nutrient enrichment of river systems and water storages. If traces of medications are found in meat products, fear that these may impair human health can lead to trade restrictions.

There are a number of important 'psychic' benefits of improved animal health. In general, the livestock producer will wish to see stock looking in good health and condition. Quite apart from the production benefits this confers, it will provide personal satisfaction. In village livestock systems, livestock owners tend to know animals individually and can be distressed to see them suffer. Also, there is research and anecdotal evidence to indicate producers gain considerable satisfaction from having high quality stock to observe and to show neighbours. For the community in general, distress over suffering of animals is a major issue, and highly active and militant animal welfare groups have formed. Particularly in developed countries, these can be effective pressure groups affecting government policies. The activities and expenditures of animal welfare groups reflect a large community willingness-to-pay to

prevent suffering by animals. Some farm animals are regarded as pets, or used for recreation activities, such as horses and buffaloes; here disease can have a cost in terms of reduced recreation of rural families.

4. VALUE CONCEPTS FOR NON-MARKET GOODS

Values of non-market goods may be divided into user and non-user values. Pearce and Turner (1990) summarise these as *total economic value* (TEV):

$$\text{TEV} = \text{user value (UV)} + \text{non-user value (NUV)}$$

As noted by Pearce and Moran (1994), these categories may be further divided into:

$$\text{TEV} = \text{UV} + \text{NUV} = (\text{DUV} + \text{IUV} + \text{OV}) + (\text{BV} + \text{EV})$$

where DUV is direct use value

IUV is indirect use value

OV is option value

BV is bequest value

EV is existence value.

In the context of animal health programs, livestock products and recreation values would constitute direct use value. Having animals in good health as an emergency food reserve or for sale whenever required could be considered an option value. Bequest value involves the quality of livestock assets which can be passed on to the next generation of farm operators. Existence values are those values placed on livestock assets independent of any direct benefits which owners or others may gain. Animal welfare concerns may be classed under this category: people have a wish to ensure the existence of good health in livestock.

Non-user values usually give rise to the greatest difficulties in concept and in estimation, as discussed in the next section.

5. METHODS OF VALUATION OF NON-MARKET GOODS

A variety of concepts and methods have been adopted to estimate values of non-market costs and benefits of animal health programs, some of which are listed in Box 2, and discussed below.

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| HUMAN CAPITAL DAMAGE REPAIR AND PREVENTION COSTS TRAVEL COST METHOD HEDONIC PRICE METHOD CONTINGENT VALUATION METHOD CONCENSUS OF EXPERTS BENEFIT TRANSFER METHODS |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

5.1 *Human capital*

The basis for this approach is that human illness and loss of life place an economic cost on society, e.g. see Winpenny (1991, p. 30), Department of Finance (1991). This cost can be determined with reference to loss of earnings, loss of potential future earnings and costs of hospitalisation and medical treatment. Improved animal health can lead to improvements in human nutrition and health, while residues from medications in meat can be inimical to human health. Various studies have placed a cost on loss of life in the range of \$0.2m to \$3m, and the cost of injury requiring hospitalisation at about \$20,000 (e.g. Loane, 1986; Lyons, et al., 1993). Improved child nutrition due to greater availability or affordability of animal products (including milk) in the diet can have an impact on future well-being and productivity of a community, for which a value could be imputed.

5.2 *Damage repair or prevention costs*

This valuation approach typically applies to environmental degradation. Adverse environmental impacts could be associated with improved animal health, due to greater grazing pressures on pastures, or from increased intensive production systems and associated noise, odour and waste disposal problems. Any switch from crops to livestock could reduce efficiency of food production and consequently place greater pressure on land and water resources. In such cases, the costs of restoration of natural resources and prevention of further degradation could be used as a measure of damage costs.

5.3 *Travel cost method (TCM)*

The travel cost method (Hanley and Splash, 1993; Sinden and Thampapillai, 1995) is a technique for measuring the demand and hence willingness-to-pay for recreation resources in terms of what people spend in travel costs to visit them. By measuring the expenditure on vehicles or fares and entry fees and value of travel time, and so on, for visitor numbers from different zones of origin, it is possible to estimate a demand curve for recreation, and hence

estimate consumer surplus for the recreation resource. Number of visits is regressed on distance from the site, income and other factors. Although difficulties can arise when travel involves multiple sites or includes business as well as recreation activities, the TCM is now widely accepted and applied as a non-market valuation method. The application to animal health economics is rather limited. This technique could be used for example to examine the benefits of improved animal health in relation to viewing animals in protected areas such as national parks, showcase farms, rare breed centres and special entertainment areas (e.g. an elephant training centre).

5.4 *Hedonic pricing method (HPM)*

This is a method used to estimate values for specific characteristics of assets (particularly real estate) and consumer goods (e.g. meat). Observed market prices can be regressed on a number of variables describing the purchaser (e.g. income) and property or commodity (including variables which measure quality, often represented by dummy regressors). For example, meat prices can be regressed on animal breed, meat colour, fat thickness, marbling and other characteristics. The estimated regression coefficients for the quality variables provide an indication of their average value over the sample of sales transactions observed. A limitation is the need for a reasonably large sample of observed sales. Also, statistical problems and in particular multicollinearity may arise when a large number of explanatory variables are included in the regression analysis. This approach has potential for estimating the effect of morbidity on livestock values. Also, it could be used to place a cost of "noise pollution" from intensive livestock production. A range of reported disamenity values for unwanted noise are summarised by Streeting (1990), in the context of airport noise.

5.5 *The contingent valuation method (CVM)*

CVM is in most cases the only way to estimate non-user values (option and existence values) of changes in asset quality. This technique has been developed and used widely in relation to resource and environmental management, particularly in the USA. A community-wide survey is conducted, in which respondents are asked how much they would be willing to pay to preserve an asset or willing to accept in compensation for loss in quality in an asset. As distinct from *revealed preferences*, this technique provides values as *stated preferences*, which are somewhat less reliable. Although expensive and subject to a number of biases, CVM is being used increasingly for environmental valuations, including estimation of damages in environmental litigation. CVM has been applied to estimate the values which

consumers place on various aspects of meat quality (Mullen and Wohlgenant, 1991). Valuations with respect to eradication of farm pests are reported by Wilks (1990). This technique would be appropriate for estimating the values landholders place on having healthy animals or not being prevented from carrying out genetic improvement by livestock diseases. For example, a livestock owner could be asked how much he would be willing to pay to have disease-free stock, or to have a new highly effective vaccine. CVM would also be well suited to establishing community valuations on animal welfare issues.

5.6 *Consensus of experts*

Where other approaches seem unworkable, a fallback position is to seek subjective consensus estimates of the likely magnitude of non-market impacts by a small group of people who have particular knowledge of a resource or production system. A meeting of a panel of 'experts' could be convened, in order to arrive at ballpark estimates of loss in productive value due to a livestock disease, or measures of social or environmental impacts. A more sophisticated approach sometimes adopted is the Delphi method (Makridakis et. al., 1983). Here a number of experts are asked independently - rather than in a group - to place values on a particular variable. Responses are collated and summarised, and presented to each respondent with an invitation to adjust their estimate in the light of these interim results. A second round of this process may be conducted. Eventually, a high level of consensus is likely to be achieved. The Delphi method is designed to obtain views from a group of experts while avoiding bias from dominant individuals. Were the group brought together, some members with genuine knowledge could defer to the superior knowledge, dominant personality or senior position in an organisation of one or more member, and be reticent to present their views.

5.7 *Benefit transfer methods*

Another approach is to place *standard* values on specific non-market goods, adapting values derived at other locations which have been reported in the literature. Often these reported studies will have used the more expensive and time-consuming valuation methods such as CVM or RPM. This approach has been applied to improved water quality and its impact on recreation values and public health (Kask and Shogren, 1994) and lake recreation (Parsons and Kealy, 1994). The latter study indicated a high degree of reliability in transferring estimated benefits from one site to another; however, it was noted that the sites were in the same state (Milwaukee in the USA) and had a high degree of similarity. Standard values have

been widely used for loss of life and hospitalisation due to illness. They could also be developed for noise pollution. This approach has potential where rapid economic assessment of non-market impacts are needed, e.g. see McGregor et al. (1994). NSW EPA (1995) have developed a database of standard non-market values to assist in this regard. Adapting values from previous research involves a number of adjustments, e.g. revision to current dollar values (adjustment for inflation) and change in currency units if using values from other countries. Even then, the acceptability of transferring values from one site to another - where community preferences and tastes and resource endowments vary - is subject to controversy, but this approach does enjoy wide use.

6. MORE DETAILED ASSESSMENT OF THE CONTINGENT VALUATION METHOD

The contingent valuation method warrants further discussion because it is the only one of the above list which really measures consumer surplus, including non-user values. At the same time, this technique is prone to various sources of bias, and tends to attract a substantial amount of controversy.

CVM involves developing a questionnaire for a postal survey or preferably face-to-face interview. At the heart of the questionnaire are questions about how much each respondent would be willing to pay to preserve a particular situation, or willingness to accept in compensation to give up a current benefit. However, this is normally preceded by a considerable amount of information about the choice situation or hypothetical market. This information is needed because the market situation is one in which respondents usually are unfamiliar. Before making purchases, people often spend a good deal of time gathering information, assessing products, comparing prices, and so on. In simulating a market, it is important that respondents have sufficiently comprehensive and reliable information to make a valuation decision, and further that they share similar information.

A number of questions are usually included to check the validity of responses, an attempt being made to build up a profile of the respondent with respect to the particular decision. Questions may be included about practices, so as to determine the practical level of concern about an issue. For example, in assessing benefits from improved stock quality, a farmer could be asked whether he is carrying out any breeding improvement program, and how stock for purchase are selected. Questions are also asked about why particular values are

nominated, to check whether the valuation involve due consideration or are made flippantly. Development of questionnaires for CVM is something of an art form, and it is usually worth searching the literature to find questionnaires developed in previous studies. A good example of such a questionnaire, in an environmental planning context, is provided by Imber et al. (1991). The statistical analysis of WTP responses can be complex, involving survival or logit analysis.

There are a number of potential sources of bias in CVM surveys. If a postal survey is used, it may be that mostly people who place a high value on the 'good' being valued return the questionnaires, leading to *non-response bias*. But even with a high response rate, there is considerable scope for misleading information being obtained. Respondents may have a clear economic incentive to reply in a particular way. For example, suppose a livestock owner were asked "How much would you be prepared to pay to have a vaccine which prevented your animals from becoming sick?" The respondent may believe the survey results will influence the government in developing improved vaccines, and judge that he or she is will not actually have to hand over any money, and hence may give an exaggerated valuation. This is referred to as *strategic bias*.

In that respondents are asked to make valuation decision with reference to a hypothetical market unlike anything with which they are familiar and have trading experience, they may have a tendency to report too high or too low a value (referred to as *hypothetical bias*). Great care much be exercised in developing information about the decision situation, since there is a risk of *information bias* affecting the responses. The form of payment may be presented in terms of say extra taxation, a contribution to a voluntary agency or higher input costs. It has been found that the valuation obtained will depend on the type of payment indicated; for example, people have an aversion to paying taxes and would report a low valuation if this were the option. This problem is known as *payment vehicle bias*.

The actual WTP questions can be presented as bidding games, in which successively higher values are nominated until a negative response is obtained. Thus the respondent may be asked "Would you be willing to pay 200 bt a year?" "250 bt?" "300 bt?" and so on until the maximum willingness-to-pay is established. Research evidence indicates this approach suffers from *initial position bias*, i.e. the final value agreed depends on the range of values presented. For this reason, a referendum or *dichotomous choice* approach is preferred, in which split samples are adopted, each respondent being presented with a single amount with

only a “yes” or “no” response sought.

In spite of the various potential sources of bias, a number of validation studies indicate that CVM results are often quite reliable and useful. On the other hand, this tends to be an expensive and time consuming technique. The potential usefulness but concerns over accuracy of CVM in the USA following its use in damages litigation over the Exxon Valdez oil spill led the US Department of Commerce, through its National Oceanic and Atmospheric Administration (NOAA) to set up the so-called Blue Riband Panel of experts led by Nobel laureates Kenneth Arrow and Robert Solow. This panel reviewed the state of the art and make recommendations concerning environmental valuation. They found that that CVM can provide estimates reliable enough to be the starting point of a judicial process of damage assessment, and recommended guidelines as to how it should be used (van Kooten, 1994).

When CVM is applied to environmental issues, there may be vested interests in discrediting the estimates. Industry spokespeople sometimes denigrate non-market values as ‘funny money’, not to be considered on a par with revenue generated by production of goods and services. However, the importance of non-market values is being increasingly realised. Accuracy remains a problem, and makes non-market values something of a target for critics. The ability to estimate these values precisely should be treated as a separate issue to the importance of including them in economic analysis.

7. FURTHER ISSUES IN NON-MARKET VALUATION

Both market and non-market valuation methods are subject to limitations which should be recognised when carrying out CBA, and some of these are now reviewed, followed by suggestions as to choice of valuation method.

7.1 Limitations of market values

Ideally, values observed in a market would be a good indication of what the community is willing to pay for a particular good or service. However, this assumes that markets are competitive, buyers and sellers have good information, and significant distortions (e.g. institutional and legal) are not present. In CBA, market prices are sometimes replaced by shadow prices, or estimates of what the prices would be if markets operated more perfectly. For example, when industries are heavily subsidised, import or export parity prices may be used, depending on the net balance of trade for a commodity. Even if markets functioned

more perfectly, the price and cost variables needed in CBA are forecasts of future values, for which high uncertainty may exist.

7.2 Limitations of non-market values

Sections 5 and 6 have indicated that estimates of non-market values may be subject to large errors. However, this concern can be overemphasised because, as indicated above, market prices also may not be reliable indicators of community willingness-to-pay. It is usually better to use whatever estimates of non-market values are available, and to make clear the data sources and judgements about reliability, than to omit these values from the analysis. Where a high degree of uncertainty about values exists, sensitivity analysis or risk analysis should be carried out as a routine part of CBA.

7.3 Public expenditure programs and wider beneficiaries

A special type of indirect benefit which is sometimes asserted for projects involving major expenditures is what is referred to as flow-on, multiplier or 'wider beneficiary' benefits. The argument is advanced that as well as generating direct industry and non-market impacts, the project will lead to additional economic activity resulting in greater regional economic output, increased community income and additional employment. Each dollar spent of the project will have a multiplier effect on the regional economy, because supply of inputs for the project will create economic activity for firms and people in 'upstream' supply industries.

This is valid to some extent, where the perspective of the analysis is to determine regional impacts of capital expenditure. However, from a national viewpoint, care must be taken not to overestimate secondary benefits. If an activity creates new jobs, this may result in skilled workers and other resources moving from deployment elsewhere, with only a small gain from a national viewpoint. Further, if funds are not invested in a particular animal health program, they will probably be used in some other activity which also has multiplier benefits.

7.4 Choice of valuation method

Ideally, the non-market valuation methods adopted would be rapid, inexpensive and accurate, and would yield estimates consistent with the willingness-to-pay and economic surplus concepts. In practice, there is no single correct method for estimating these values, and the best approach will depend on the particular circumstances. In that CBA often has to be carried out quickly and to a tight budget, there is usually an imperative to use a method which

provides rapid assessment at low cost. Benefit transfers and expert opinion approaches such as and the Delphi method can be favoured in these situations, whereas alternatives such as the hedonic price and contingent valuation methods may prove too costly and time consuming.

8. CONCLUDING COMMENTS

Many of the costs and benefits of animal health programs are difficult to estimate. Important among these are non-market values, i.e. impacts which do not result in changes in quantities of livestock or other products traded in markets. In that private benefits and costs of animal health programs do not accord with social benefits and costs, government intervention may be warranted to promote optimal resource use. Management decisions have to be made with imperfect information about non-market values, but this is no reason for not taking these values into account. In the longer term, better estimates should become available.

Non-market valuation techniques are sometimes appropriate for estimation of values of market goods and services. In particular, methods of obtaining consensus opinions from experts may be appropriate where little relevant information is available and the alternative would be further long-term research.

Cost and time requirements in carrying out survey-based non-market valuations can be very large, and results subject to a high degree of error, hence low-cost expedients such as benefit transfers are likely to be widely used. Sometimes it is argued that non-market values are not 'real money' and should be discounted. This can reflect concern over reliability of estimation methods. If estimates are made with care, there is no reason why non-market values should not be treated in the same way as market values when carrying out CBA.

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