

Sustainability and economic investments in animal health systems

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Summary

The paper outlines a framework for shaping and prioritising improvements to investments in animal health systems in order to improve their sustainability. The framework includes financial inputs that can be separated between core investments and day-to-day expenditures. The latter financial inputs should differentiate between avoiding losses in production and reducing wider societal impacts such as negative implications for trade and the environment. Overall the framework provides information on the financial costs of the animal health system and the animal health outcomes that, if collected over time, will allow the efficiency of resource use across the system to be measured.

It discusses an application of the framework using existing data, which highlighted problems with measuring and costing veterinary inputs, and with quantifying the range of outputs and the impact of veterinary activities. The paper recommends that the framework proposed is reviewed and compared with work that has been carried out on the human health accounting systems. A true application of the framework will require data sets that can differentiate between public-sector, private-sector and non-governmental organisation investments and the cost of day-to-day animal health goods and services paid by animal owners. Data sets are also needed on animal health outcomes in order to compare investments with animal health outcomes and thereby: demonstrate the success of previous investments, identify weaknesses in the investment profile and ensure that future investments sustain an animal health system, which functions well.

Keywords

Animal health systems – Economics – Investment – Veterinary Services.

Introduction

Animal diseases and zoonoses cause a range of losses that can be accounted for through estimates of mortality and morbidity in animals and humans. When such losses become apparent, a localised response normally takes place to manage the resultant problems, through a mixture of surveillance, prevention and control actions (1). The overall impact of these diseases is therefore a mixture of loss in production from animals, impacts on human health and the reaction of people to mitigate the worst impacts of disease (2). Some of the mitigation actions of surveillance, prevention and control require significant investment in research and infrastructure that could never be provided by individuals or even by large farm enterprises. There is also the need for coordination actions that go well beyond the responsibility of individuals. Such significant investment

and coordination indicate the need for state-level investment at the national, regional and global levels. This results in a critical group of people who work in the ‘animal health system’ (or the Veterinary Services) covering the public- and private-sector investments, and the management of health by veterinarians, animal health workers, veterinary nurses and livestock owners. These people can be relied upon to provide skilled services in disease surveillance, control and prevention strategy development; to coordinate programmes and to effectively use and organise public- and private-sector investments in order to generate a wider public good of improved animal health and welfare. Achieving the level of ‘economic investment’ to achieve a ‘sustainable animal health system’ is a challenge for governments across the world, and one that needs constant revision as societies and economies change, leading to changes in the roles of animals in people’s lives (3, 4).

This paper will examine how current animal health systems are funded and will ask the question: is the investment in animal health systems adequate to achieve a sustainable level of coordination and resource use so as to limit the major impacts of animal disease and zoonoses? It builds upon the work of:

- McNerney (5), who examined the balance of loss and expenditure in animal health
- Tisdell (6), who, through his work on Thailand, modified McNerney's loss and expenditure model and included an understanding of the need for a fixed-cost investment in Veterinary Services in order to effectively coordinate disease control programmes
- Civic Consulting (7), which has used the theoretical frameworks and empirical data from a number of countries as its basis for estimating the fixed-cost level in different settings; and as a comparator for how the additional veterinary system costs relate to a country's livestock units.

In fact, the final study went further and examined the gap between current funding levels and the required optimal level of investment to allow for the effective control of animal diseases and zoonoses. Civic Consulting reported a simple linear correlation between the gross domestic product of case-study countries and their investment in animal health systems. However, it pointed out that this gave no indication of the optimal level of investment to achieve this and that assessments may be more effective if focused on key elements of veterinary intervention, rather than total expenditure. The report also concluded that there was a need to collect better data in order to enable the benchmarking of animal health systems. The above-mentioned issues are revisited in this paper, and through this process, a methodological framework for measuring and strengthening animal health systems is developed.

The paper has three main sections. The first covers the development of a framework leading to a system of analysis for available data. The second is followed by a discussion based on the application of the framework to available data. Finally, the third, based on the analysis, makes recommendations on how investments in animal health systems can be made more sustainable.

Developing a methodological framework for investment in animal health systems

An economic assessment requires a framework to enable the measurement of the inputs, impacts and outcomes of the animal health system that are being collected. Using these

data, it will then be possible to compare and benchmark animal health activities, with the goal of assessing the levels of funding necessary to ensure the effective delivery of a high-functioning animal health system. Additional data are required to investigate the optimal level of government investment and the allocation of resources within Veterinary Services in order to minimise the impact of animal diseases and zoonoses. This section will provide details of a proposed framework for investment in animal health systems. It includes a brief description of the animal health system to identify critical financial and resource flows. It will then define what the core inputs and outputs of the system are, and, in the process, begin to look at how the impact of animal disease problems and issues can be assessed.

Animal health systems

Animal health systems cover a range of people and organisations. The key aspects of such systems are:

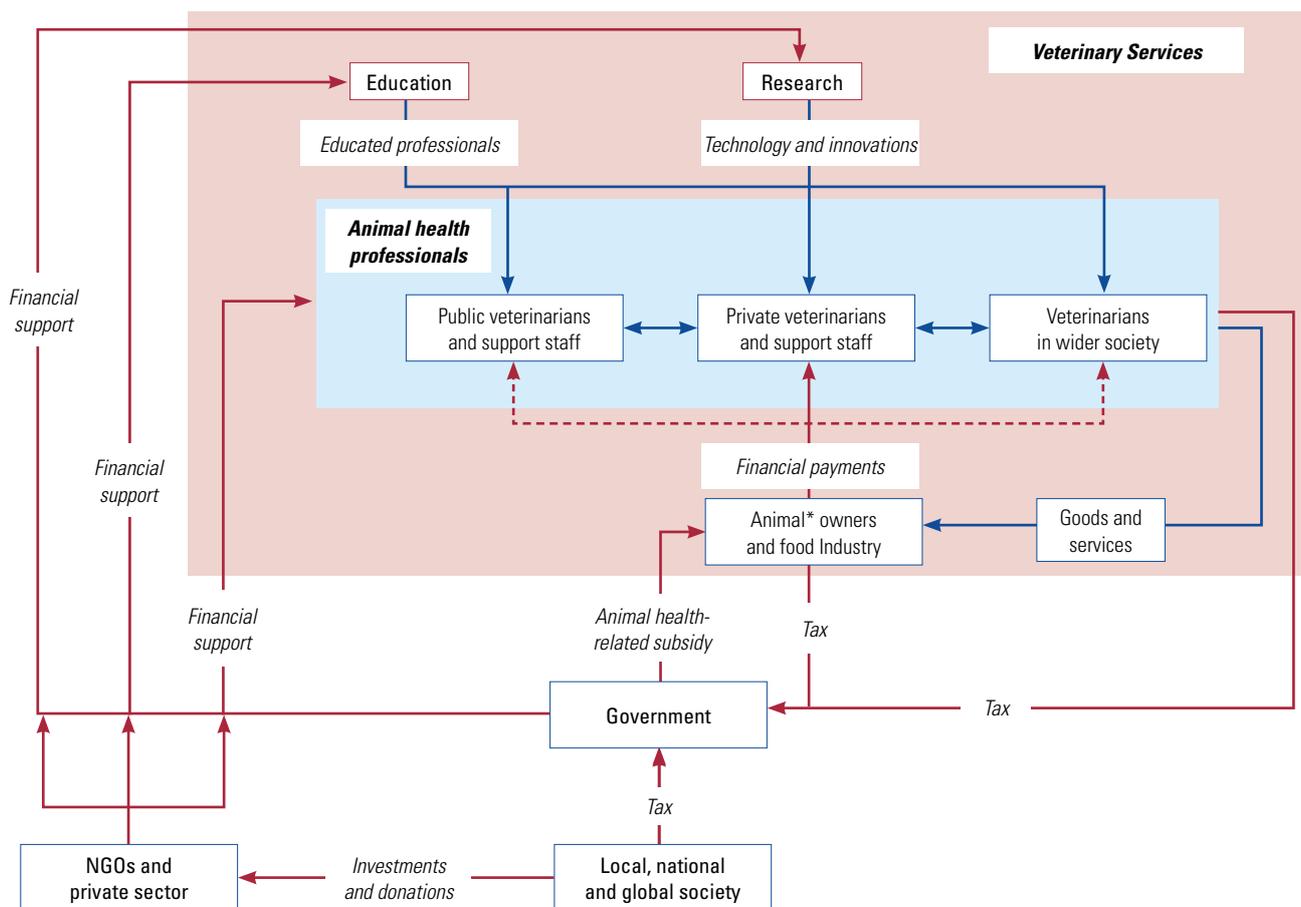
- i) investors in education, research and core veterinary staff and infrastructure:
 - government
 - private companies
 - private individuals
- ii) clients of the veterinary goods and services generated:
 - livestock owners
 - governments
 - private companies
- iii) educational organisations which educate people as veterinarians, animal health workers and veterinary nurses
- iv) research organisations which develop technologies on animal health and disease management
- v) a core group of veterinary animal health professionals that can be split into:
 - veterinarians and support staff working in the public sector, specifically on animal health
 - veterinarians and support staff working in the private sector, specifically on animal health
 - veterinarians and other animal health professionals who work in the wider society
- vi) animal owners who can be divided into:
 - livestock owners – people involved in the production of meat, milk, eggs and fibre
 - members of the food industry who have the responsibility for the safety of food and products produced from animals
 - owners of animals used to generate power for land preparation and transport

- companion animal owners
- sporting animal owners – people who own racing and eventing animals.

These groups of people are linked through processes of taxation and monetary flows. In a sustainable animal health system, there is sufficient investment by the public and private sectors in education, research, and core veterinary staff and infrastructure so as to ensure that general animal health problems are well managed and that acute events, such as the introduction or emergence of disease, can be controlled. The financing of these investments can be achieved through taxation and channelled through government allocation as well as through private individuals and companies making investments in certain aspects of the Veterinary Services. In addition, donations to non-governmental organisations allow these organisations to play a role. A strong and sustainable animal health system will therefore have investors who are interested in the system employing well-educated people – veterinarians, animal health workers and veterinary nurses – who have access to good infrastructure and research technologies

in order to achieve optimal animal health outcomes. In addition, animal owners and the livestock food industry will pay for the goods and services offered by the veterinary professionals to carry out both minor and major animal health improvements (Fig. 1).

The representation of the animal health system provides information as to which data are important when assessing the system with regard to financial flows. There is a need to identify the investment in education, research and core staff and infrastructure; ideally, these should identify who has financed these components and the motivations for the financing. In addition, financial flows from animal owners and the food industry pay for day-to-day animal health tasks that draw on the core investments made by society as a whole. Governments may well support animal owners and the food industry through subsidies on animal health interventions; however, they also need to recognise that these groups contribute to government income by paying taxes. In fact, all aspects of the Veterinary Services contribute taxes back to government. In an ideal system, the investments and the day-to-day payments for animal



*Includes livestock, companion and sporting animals
 NGO: non-governmental organisation

Fig. 1
Flows of investment, taxation and critical resources within Veterinary Services

health goods and services should deduct the taxes paid by the Veterinary Services as follows:

$$\text{AHI} = \text{PPI} + \text{PG\&S} - \text{T}$$

AHI: animal health investment

PPI: public and private investment (financial support flow) (Fig. 1)

PG&S: day-to-day expenditure of goods and services (financial payment flows) (Fig. 1)

T: taxation.

Each item can be broken down more carefully and the next section will look at what society gains from this overall input.

Input and outcome of the Veterinary Services

In the previous section, the overall financial input to the Veterinary Services was described. This input will be used by Veterinary Services to manage health, and disease and welfare problems in animals that can be spread to food, transport, companion and sporting animals. In turn, this will generate animal health outcomes such as reduced disease presence, animals that are healthier and that are kept in welfare-friendly environments, and animals and products that pose fewer risks to humans, wild animals and the wider environment. Figure 2 summarises the flow of input to and the animal health outcomes of Veterinary Services.

Identifying the inputs and the outcomes from the veterinary system allows them to be combined so that efficiency can be measured.

$$\text{Veterinary Service efficiency} = \frac{\text{Animal health outcomes per unit of time}}{\text{Animal health inputs per unit of time}}$$

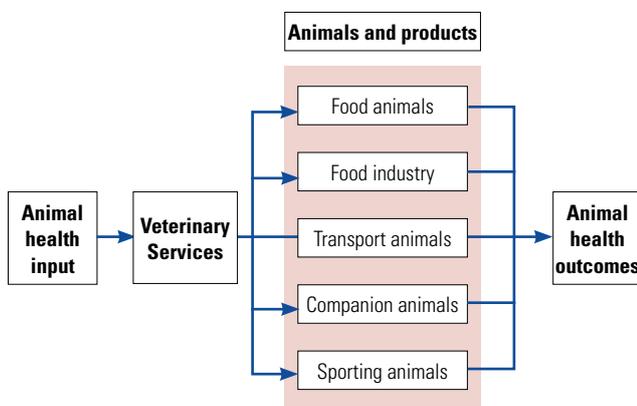


Fig. 2
Input and outcomes from Veterinary Services

On the animal health input side, investments in the Veterinary Services should be determined and separated from the day-to-day payments for animal health goods and services. The balance between the core investment and the day-to-day costs will affect the ability of the Veterinary Services to manage animal health, and to absorb the introductions and emergence of animal health problems.

The inputs to the system can be largely quantified in monetary terms. The animal health outcomes have different units. Food animals and the food industry can largely be measured in monetary terms, yet the animals used for transport may involve monetary gain, but will also be part of bartering systems and non-monetary intra-household transactions. Companion and sporting animals also result in a mixture of monetary and non-monetary outcomes. In all cases, it is unlikely that the welfare gains from the Veterinary Services can be determined easily in monetary terms.

Despite these difficulties, there is a starting point for assessing the efficiency of the Veterinary Services and the simple formula presented above allows for the inputs and the outcomes to be investigated. Where outcomes are difficult to determine in monetary terms, a qualitative assessment can be undertaken that describes the overall aspects of the outcome and who in society would benefit. Alternatively, through the use of 'hedonic' or willingness-to-pay assessments, a monetary value can be placed on these outcomes. The method used is dependent on the resources available and on the skill of the analysts concerned.

Role of total and marginal (incremental) cost analysis

Ideally, in addition to data on the overall level of veterinary activity in a country, determining the optimal level of veterinary intervention and policy priorities should be underpinned by evidence of marginal or incremental analysis (2, 5, 8). This involves building a detailed understanding of the costs and benefits at the margin associated with changes in activities or capacity (e.g. the impact of additional vaccination programmes, extra training and the provision of new laboratories). Such costs and benefits may vary significantly between countries. However, with sufficient data, quantifiable analysis and modelling should enable opportunities to be identified where the modification of public expenditure leads to an improvement of disease management and reduces the overall disease impact in a way that leads to a return on public investment. The process of prioritisation needs to create a balance between the active and passive measures of managing a disease or animal health problem (9).

Overall framework

The flows within the Veterinary Services of money and resources have been described above (see Fig. 1), as have external investments in the Services' education, research, staff and infrastructure. The internal financial flows within the Veterinary Services have been identified as dealing with specific health- and disease-related problems, and have been termed 'day-to-day payment' of animal health goods and services. The framework presented recognises that expenditure on day-to-day goods and services is anticipated to avoid losses caused by animal health and disease problems (5). The level of public and private investment in the core Veterinary Service aspects of education, research, staff and infrastructure affects this relationship between expenditure and loss. Therefore, there are two aspects of the overall financial input to the Veterinary Services, which are related and which affect the efficiency of the inputs' use. Figure 3 illustrates a shift in the loss expenditure curve as a result of investment in core activities. This both implies a significant overall fixed cost to the service, yet improves its ability to manage animal health and disease problems.

For example, a Veterinary Service with low levels of investment in core activities will have poorly educated and equipped staff to utilise the day-to-day payments made by livestock owners. Therefore, the ability to manage disease and health problems will be impeded, and the efficiency of resource use will be poor. Conversely, a poor policy and business environment for animal owners may lead to low levels of day-to-day financial payments to the Veterinary Services, leading to poor animal health outcomes and a poor utilisation of the investments in core activities. Achieving a balance between core investments and the appropriate incentives for animal owners to pay and act in the management of animal health and disease problems is key to the efficiency and sustainability of the overall Veterinary Services.

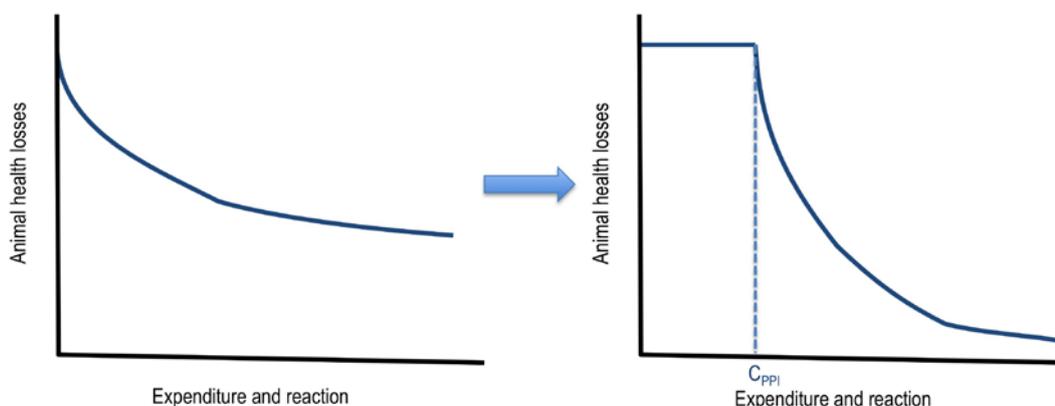
In summary, financial inputs to the Veterinary Services can be separated between core investments and day-to-day expenditures. Such inputs are directly and indirectly aimed at avoiding losses in production, and wider societal impacts such as negative implications for trade and the environment (Fig. 4).

Overall the framework gives information on the financial costs of the Veterinary Services and the animal health outcomes that if collected over time will allow for the measurement of the efficiency of resource use across the system. This efficiency could relate to the overall system and could occur as a result of core investment in the day-to-day expenditure.

Application of the framework

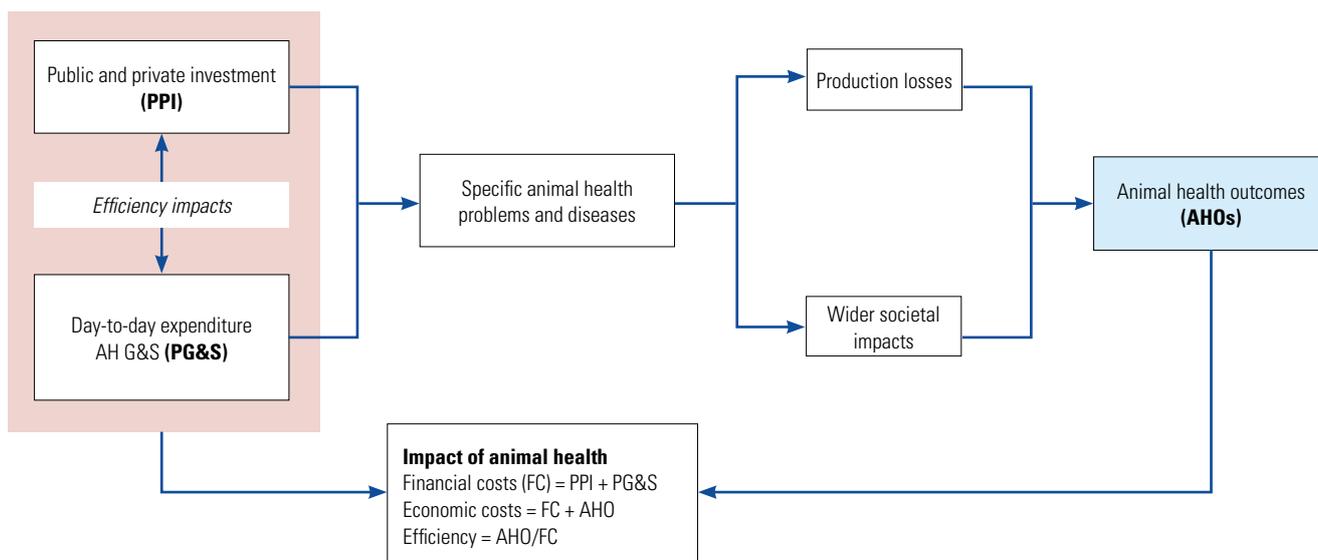
The most detailed information available on Veterinary Service investment comes from the gap analysis data and the published country level gap analysis reports of the World Organisation for Animal Health (OIE). These are discussed in the following section with the intention of investigating if they provide sufficient information to reach reasonable conclusions on the efficiency of the Veterinary Services.

Rushton and Jones (10) attempted to apply the framework to the existing Performance of Veterinary Services (PVS) data. They concluded that the current information collected on animal health accounts at the national and global levels is fragmentary at best, and inconsistent and absent at worst. In such a situation the analysis of available data and its interpretation for aspects of optimal investment in animal health systems becomes so dependent on assumptions that it can be easily challenged. The current analysis has highlighted a number of key findings.



C_{PPI} : cost of public and private investment

Fig. 3
Transition of the loss-expenditure relationship with a core investment in education, research, staff and infrastructure



AH: animal health
 G&S: goods and services
 PG&S: day-to-day expenditure of goods and services

Fig. 4
Summary of the financial costs and animal health outcomes of Veterinary Services

Gap in investment

It is clear that the amounts of capital and labour resources invested in Veterinary Services by countries differ significantly, whether measured in simple, absolute terms or in normalised terms using veterinary livestock units per veterinarian, or other comparator metrics. However, there is no defined optimum level of expenditure, although the evidence from the published gap analysis reports suggests that having some defined assumptions about the expected veterinary activity per head of cattle per year provides a logical basis for determining an overall budget that is sufficient to match the assumed degree of activity. However, this method of activity-based costing is circular as it does not provide evidence to determine which priorities should be adopted or how successful the activities have been in meeting their overall objectives.

Gap in the allocation of public and private resources

It is unclear how much of the information in the reports reflects the 'true' economic costs of the listed activities, as there is no external validation or benchmarking in place to test their reasonableness. Furthermore, the extent to which the data cover both public- and private-sector investment is also unclear. Some reported data sections appear to relate to public-sector provision only, and there is a need for a more consistent approach to the process of data capture.

Coordination skill deficit

In addition to measuring quantity, the process of benchmarking and improving activity measures also requires the quality of the inputs and outputs to be determined. The development and adoption of methods to measure quality, skills, etc. are needed to ensure that the resources are properly coordinated.

Gap in data collection, capture and analysis

Disease impact

The data sheets used for data collection record the diseases that exist in the countries in question, but little more. Preferably, they need to show how the activities impact upon animal disease – ideally, the outcomes expected should be analysed, not just the cost of the activities. Better disease impact studies, which observe the consequences of particular interventions, would enable an incremental approach in order to determine the impact of changing the use of resources (11).

Optimum levels of resource allocation

The economic assessment of optimum levels of public and private resource allocation needs to consider the following:

- what data are being collected?
- which are not, and why not?

- which missing data are critical to the economic assessment?
- what would be the cost of collecting the missing data?

A potential problem in the collection of data on the animal health system is the lack of data on the impact of diseases at the national level. Data on whether a disease is present in a specific country are available, and some details on the animals affected can be extracted from the World Animal Health Information Database (WAHID), but this captures a very narrow aspect of disease impact.

Discussion

Given the bleak view presented above on the potential to use PVS data combined with other secondary sources of data, the authors have searched human health literature to see how human health researchers have overcome such problems. Over the last 20 years, there has been a serious attempt to accurately describe the losses in human health due to disease and illness through repeated studies on the global burden of disease. There has also been a recent assessment of the foodborne disease impacts through the Foodborne Disease Burden Epidemiology Reference Group of the World Health Organization. In addition, there has been a dedicated effort to capture data on expenditure on health and also on the financing of the human health system (12, 13), which has been backed by a mechanism to support the systematic collection of data (14). The 2011 Organisation for Economic Co-operation and Development system of health accounts has added the need to capture and measure health burdens in order to essentially follow the same framework as shown in Figure 3, which details losses and expenditure. This builds on decades of work with regard to the collection and capture of data on human health expenditure and human health outcomes (15).

The framework outlined in the paper follows a similar structure to the human health accounting system (12, 13). In addition, there are areas of the PVS where data required are being collected. The solution to these issues is:

- i) to build and strengthen the existing system through a mechanism that identifies which additional data need to be added to the current collection protocols. From the analysis carried out, this should include:
 - a differentiation between the financial costs that are governmental and private-sector investments, and the costs of day-to-day animal health goods and services paid by animal owners (e.g. 16)
 - some attempts to capture the major disease and health problems (17), their level of presence and the overall losses in production, trade and on the wider economy;

ii) to ensure that the process of capturing financial cost and animal health outcome data becomes a regular aspect of animal health services at the national level;

iii) to encourage the OIE to begin the process of capturing these data in its WAHID system in order to allow for an overall estimate of critical global issues of:

- the number of animal health professionals
- the financial cost of Veterinary Services split by investment and day-to-day costs
- an estimation of the animal health outcomes for major national-level problems.

The overall aim of this work would be to generate longitudinal data sets that allow for the investigation of the efficiency of individual disease control programmes, and the efficiency of the overall animal health system. Such information will help future allocations of resources and assist in winning additional ones. These will be the building blocks of a sustainable animal health system.

Acknowledgements

Jonathan Rushton thanks the OIE for inviting him to contribute this paper to the volume and his employers (the Royal Veterinary College and the University of Liverpool) for providing him with the time to write and submit the article. The authors recognise the contributions of Joseph Domenech and Marie Edan who provided their initial thoughts on the analysis, and their support through the writing of a report in 2015.

Les investissements financiers pour des systèmes de santé animale durables

J. Rushton & D. Jones

Résumé

Les auteurs exposent les grandes lignes d'un cadre permettant de définir et de hiérarchiser les améliorations à apporter aux investissements dans les systèmes de santé animale en vue d'une meilleure durabilité. Le cadre prévoit les apports financiers à prendre en compte, qui peuvent être répartis en investissements de fond et dépenses de fonctionnement. Ces derniers apports devraient établir une distinction entre les pertes de production qu'ils permettent d'éviter et l'atténuation d'impacts sociétaux plus larges tels que les effets négatifs des maladies sur le commerce et l'environnement. Dans l'ensemble, le cadre fournit des renseignements sur les coûts financiers d'un système de santé animale et sur les résultats obtenus ; collectées sur des durées longues, ces données permettront de mesurer l'efficacité de l'utilisation des ressources au sein du système.

Les auteurs analysent les résultats d'une application du cadre à partir de données existantes, qui mettent en évidence les problèmes liés à la mesure et au chiffrage du coût des intrants vétérinaires et à la quantification des divers extrants et de l'impact des prestations vétérinaires. Les auteurs recommandent que le cadre proposé soit réexaminé et comparé à d'autres travaux relatifs aux systèmes de gestion financière de la médecine humaine. Une véritable application du cadre devra faire appel à des séries de données capables de différencier les investissements suivant leur provenance (secteur public, secteur privé, organisations non gouvernementales) et le coût des biens et services courants de santé animale pris en charge par les propriétaires d'animaux. Il faudra également disposer de données sur les résultats obtenus en santé animale afin de comparer les investissements avec ces résultats et de démontrer ainsi le succès des investissements réalisés, identifier les points faibles de la stratégie d'investissement et s'assurer que les investissements à venir soutiennent un système de santé animale qui fonctionne bien.

Mots-clés

Économie – Investissement – Services vétérinaires – Système de santé animale.



Sostenibilidad e inversiones económicas en los sistemas de sanidad animal

J. Rushton & D. Jones

Resumen

Los autores describen sucintamente un marco destinado a formular y jerarquizar medidas de mejora de las inversiones en los sistemas de sanidad animal para lograr que estos sean más sostenibles. Dicho marco incluye las aportaciones económicas, que pueden dividirse en inversiones básicas y gastos corrientes. Dentro de estas aportaciones conviene distinguir entre aquellas destinadas a evitar pérdidas productivas y aquellas que apuntan a reducir consecuencias de

mayor calado para la sociedad, por ejemplo efectos negativos sobre el comercio o el medio ambiente. Globalmente, el marco ofrece información sobre los costos económicos del sistema de sanidad animal y los resultados zoonosarios que, cuantificados a lo largo del tiempo, permitirán medir la eficiencia con que el conjunto del sistema utiliza los recursos.

Los autores refieren una aplicación del marco en la que se emplearon datos concretos, lo que puso de manifiesto la existencia de problemas para medir las aportaciones veterinarias y evaluar su costo y para cuantificar los diversos resultados y efectos de la actividad veterinaria. Así pues, los autores abogan por revisar el marco propuesto y compararlo con el trabajo ya realizado en relación con sistemas de «contabilidad» de la salud humana. Para aplicar realmente este marco harán falta conjuntos de datos que permitan discriminar entre las inversiones del sector público, las del sector privado y las de organizaciones no gubernamentales y determinar el costo que tienen los bienes y servicios zoonosarios cotidianos para los propietarios de animales. También se necesitan conjuntos de datos sobre los resultados zoonosarios, que sirvan para comparar las inversiones con los resultados obtenidos en sanidad animal y, de este modo, demostrar el éxito de inversiones previas, detectar deficiencias en los patrones de inversión y asegurarse de que las futuras inversiones vengan a sostener un sistema de sanidad animal que funcione debidamente.

Palabras clave

Economía – Inversión – Servicios Veterinarios – Sistema de sanidad animal.

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