
Costs and benefits of animal identification and traceability along the agrifood supply chain

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The analysis of costs and benefits of an animal identification and traceability (AIT) system for the different stakeholders gives key information for its design and implementation. This analysis should be undertaken for each national AIT system, for each species, without confusing animal identification and animal traceability. Few general conclusions could be drawn from the numerous evaluations of costs of AIT systems, as well as the elements of a conceptual framework addressing such a cost-benefit evaluation. The paper presents these elements in four steps:

1. Precise description of the AIT system and the target agrifood sector.
2. Inventory and categorization of stakeholders.
3. Cost evaluation for each stakeholder.
4. Cost-benefit evaluation for each stakeholder.

The paper deals only with live animal identification and traceability (AIT), which is a part of a wider system to ensure agricultural products traceability. AIT systems have been implemented for different species everywhere in the world. However, the economic literature on farm animal traceability systems is rather scarce. There are lots of detailed reports about their running costs [1, 2], but little information about their quantified benefits [3, 4]. Existing papers focus on the effect of AIT systems on the control of animal diseases. A cost-benefit analysis of an AIT system would provide information to:

- Decide between different variants of the AIT system, before its implementation.
- Analyze the impact of technical changes, e.g. introduction of electronic identification.
- Decide on how to finance the AIT system, e.g. according to cost-benefit ratios for the different stakeholders.
- Assess the acceptability of the system by the stakeholders.

A cost-benefit analysis is required for each AIT system because the results depend on many factors like the organization of the AIT system, the characteristics of the target agrifood sector, the labor cost for the actors, etc.

Summary

Introduction

Since the costs and the complexity of a traceability system may be much higher than those of an identification system, the stakeholders involved in a traceability system are more numerous and diverse than those involved in an identification system, and the benefits and the impact of these systems on the target agrifood sector are different, this paper considers them as two different systems with different finalities:

1. Animal identification provides a standardized, shared, lifetime, unique and readable number on a mark applied to the animal (eartag, bolus...). An animal number may be used for different purposes, among which animal traceability.
2. Animal traceability is the aptitude to find the history, the use and the localization of an animal by the mean of a number. The number may be an animal number or a number referring to the holding of origin. In the latter case, the number may be applied either to the animals or to the batch to which the animal belongs.

The objective of the paper is to give the elements for developing a four-step framework that facilitates the evaluation of costs and benefits for the different stakeholders involved in an AIT system. These steps are:

1. Detailed description of the AIT system and the target agrifood sector.
2. Inventory and categorization of the stakeholders of the AIT system.
3. Cost evaluation for each category of stakeholders.
4. Cost-benefit analysis for each category of stakeholders.

**Detailed
description of the
AIT system and
the target
agrifood sector**

The objective of this step is to collect the information necessary for the assessment of costs.

For the AIT system, the costs assessment requires a detailed descriptions of:

- The processes of the AIT system (business processes, management processes, support processes, data management processes, etc.).
- The tasks of the actors for each of the processes in order to evaluate the required amount of labor.
- The marking system; conventional or electronic eartag, bolus or insert, individual animal number or group number, etc.
- Cost of services such as mailing, communication, hosting of the database.
- The investment and the running cost for data management.

For the target agrifood sector, the costs assessment requires the collection of:

1. Figures about:
 - Animal population size, born animals, animal movements and mortality.
 - Keepers and holdings per type (farm, collecting centers, abattoirs...), and their repartition according to their size.
 - Standardized cost of labor.
 - Etc.
2. Information about:
 - Public regulations related to disease eradication, control of animal movement, etc.
 - Type and importance of services provided to farmers (advisory or extension, milk recording, voluntary animal health improvement program, etc.).

- Farm management practices.
- Use of on farm automatic devices for milking, feeding, etc.
- Animal marketing patterns.
- etc.

The objective of this step is to get a detailed inventory of stakeholders, persons or organizations, with vested interest in AIT. These include public institutions, farmers, abattoirs, etc. The interest may be different within a given category of stakeholders. For example, the interest of a smallholder is generally different from that of a large scale farmer. The stakeholders should therefore be grouped in categories relevant to cost-benefit evaluation, with differentiation within categories. The following categories of stakeholders are often identified:

- Government.
- Public administration managing programmes related to animal health, food safety and related direct public funding (subsidy, compensations, etc.).
- Farmers, divided into subgroups: large farms, small farms, collective herds, medium size dairy farms, suckler herds of beef breeds, fattening farms, etc.
- Providers of services: animal health voluntary programmes, data performance recording, herd book keeping, artificial insemination, voluntary quality product program, etc.
- Insurance companies.
- Traders, divided into subgroups: collecting center of trade companies, sales yard, haulers...
- Abattoirs.
- Rendering plants.
- Meat processors and retailers in case of an official meat labeling.
- Consumers.
- Etc.

Two main types of cost are to be considered; implementation and annual operational costs. A cost-benefit analysis should be based only on the operational costs, which can be distributed into the following categories:

1. Indirect costs for:
 - Permanent technical team.
 - Data management.
2. Direct costs for:
 - Holding and keeper identification.
 - Animal identification.
 - Animal traceability.

Inventory and categorization of stakeholders involved in the AIT system

Cost estimation for each category of stakeholders

Indirect costs

Permanent technical team. The AIT system needs a permanent technical team. Its main tasks are:

- Permanent improvement of the procedures.
- Elaboration of indicators to monitor the implementation of the procedures by the actors.
- Information, training and support of the actors.
- Data administration (e.g. fix the errors).
- Advising the manager of the AIT system and the competent authorities.

Data management. Efficient data management services are required for holding identification, animal identification and animal traceability. The main components of the cost are the software and equipment investments, the software licenses, the software maintenance, the hosting and the communication.

Direct costs

Holding and keeper identification. That is the cost to register and update data of the holdings and their keepers. The unit for the cost calculation is the number of holdings. Its components are the keepers and administrative labor cost. This cost is independent of the species and the size of the holding. When there is a lot of small keepers, this cost may be relatively high.

Cost of animal identification. The unit for the cost calculation is the number of identified animals and the number of keepers. The main components are the labor cost of keeper, the cost of the mark (Eartags, bolus, insert...), the cost of retagging and the administrative labor cost. The major cost variations depend on the technology used for marking (plastic tags or electronic identification) and on the rate of retagging. The latter may vary from 7.5 to 11.5% [5] for eartags depending mainly on the quality of the eartag, the quality of the applicator, the technical support (communication, training, follow up, etc.) and the farming conditions.

Cost of animal traceability. The objective is to get, from the birth of the animal to its death, the full and consistent series of periods of presence in the different holdings. The cost unit is the number of individual movements (arrival or departure from a holding), as well as the number of keepers. The major components are:

- Movement registration: keeper's labor is about 1 minute 30 seconds per movement, according to the EU Commission Joint Research Center's studies [6].
- Movement notification: keeper's labor cost and cost of communication.
- Invalid data correction (3,5% to 7 % of movements for a running AIT system [7]): keeper's labor cost, communication cost and labor cost of the permanent technical team.
- In case of animal paper passport, the following costs should be added:
 - Specific secure papers.
 - Printing.
 - Mailing.
 - Keeper's labor for passport filing.

Two types of benefits should be considered separately; Government and other stakeholders benefits.

Cost-benefit

Generally, the objective is to enhance country's ability to quickly and successfully contain a food safety incident or a disease outbreak. In some cases, the objective is also to help (maintain) access to key export markets. There is a lack of information about the way to quantify these benefits. The example of foot and mouth disease shows that the difficulties of these evaluations are not in the costing of the disease but in the low and the unpredictable probability of an outbreak, as well as in the percentage of registered animals in the case of a voluntary AIT system [8]. A study conducted in 2001 analyzed the economic impacts of animal identification systems using a hypothetical foot-and-mouth disease (FMD) outbreak in the United States. According this study, an improved animal identification system in cattle could provide economic benefits with average benefit-cost ratios ranging from 1.24 to 3.15 [9].

Government benefits

Animal identification. At the farm level, the benefits from animal identification depends on:

- The farm management system, which requires animal identification for data recording (production, mastitis, food consumption...) and for acting on the animal (treatment, blood sampling, artificial insemination...)
- The number of automatic devices for feeding, milking, etc.
- The number and the importance of service providers requiring animal identification to provide their services: advice services, performance recording, pedigree recording, blood sampling for disease testing, etc.

A standardized and shared animal identification avoids implementing specific systems for each type of activity. It allows to combine information from different databases to provide the desired services, including herd management. The resulting benefit may be high in comparison with the cost of animal identification. A recent Danish study [10] gives an example of benefits for large intensive and specialized dairy herds. The conclusions may not be the same for other types of farms. The benefits are not evident for smallholders, who may have limited or no need of animal identification for the management of their herds. However, benefits may be found for the service providers supporting them (advice service, pedigree recording, blood sample for testing animal disease, property guarantee, animal insurance, animal premium, etc.)

For traders and abattoirs, the benefits depend on the marketing systems. When live animals are sold according to their live weights, and are paid according to their carcass weight and quality, the animal identification facilitates the billing and may be used for better transparency of the markets.

Animal traceability. An efficient database allows a better response of veterinary services in case of disease outbreaks or food safety problems. The animal passports allow a better control of animal movements between holdings with different health status and facilitate the eradication of contagious diseases of high importance for livestock production. It allows also to implement quality product programmes along the supply chain and to solve legal problems dealing with the liability about the food safety. However, these benefits are often potential and depend on many factors

Other stakeholders benefits

such as data reliability, delay for updating the databases, technical and legal availability of the data for the stakeholders, ability to deliver simultaneously traceability data and other types of data (animal health, food safety), etc.

Conclusions

Little information exist about cost-benefit analyses of AIT. These can be drawn from similar systems in other countries or for other species. A specific analysis is necessary for each national system and for each species. As many organizations or persons have an interest in AIT, the analysis should be done for each group of stakeholders. The main difficulty in the cost evaluation is the assessment of the amount of labor for the actors. Information on the methodology for the evaluation of benefits is rather scarce, especially with regards to animal health. The cost-benefit ratios are not the same for all the stakeholders, and the government savings from a better management of animal disease outbreaks are only a part of the overall benefits [11].

References

1. **U.S. Department of Agriculture** (2009) "Overview report of the benefit cost analysis of the national animal identification system - Animal and Plant Health Inspection Service" USDA Report.
2. **Agriculture and agri food Canada** (2007) "Costs of Traceability in Canada Developing a Measurement Model" Report.
3. **A. G. J. Velthuis; H. Hogeveen; M. C. M. Mourits; M. A. Dolman; H. Van Wichen; A. Gaaff** (2009) "Costs and reliability of livestock traceability systems for the Dutch sheep and goat sectors" Food Economics - Acta Agriculturae Scandinavica.
4. **L.J. Butler, J.W. Oltjen, V.J. Velez, J.L. Evans, F. Haque, L.H. Bennett and G. Caja** (2009) "Cost-Benefit Analysis of the U.S. National Animal Identification System (NAIS) in California" Presentation to the 60th Annual Meeting of the Europe Association of Animal production.
5. **J. Milan, G Caja et al.** (2005) " Cost evaluation if the use of conventional and electronic identification and registration systems for the national sheep and goat populations in Spain" Journal of animal science.
6. **G. Fiore, F. Naatale, J. Hofherr** (2009) Economic "Analysis of Electronic Identification(EID) of Small Ruminants in EU Member States" Presentation to the 60th Annual Meeting of the Europe Association of Animal production.
7. **A. G. J. Velthuis; H. Hogeveen; M. C. M. Mourits; M. A. Dolman; H. Van Wichen; A. Gaaff** (2009) "Costs and reliability of livestock traceability systems for the Dutch sheep and goat sectors" Food Economics - Acta Agriculturae Scandinavica.
8. **L.J. Butler, J.W. Oltjen, V.J. Velez, J.L. Evans, F. Haque, L.H. Bennett and G. Caja** (2009) "Cost-Benefit Analysis of the U.S. National Animal Identification System (NAIS) in California" Presentation to the 60th Annual Meeting of the Europe Association of Animal production.
9. **Disney W.T., J.W. Green, K.W. Forsythe, J.F. Wieners, and S. Weber** (2001) "Benefit-Cost Analysis of Animal Identification for Disease Prevention and Control."Scientific and Technical Review.

10. O.K. Hansen (2010) "Introduction of mandatory electronic identification of cattle in Denmark" Presentation from the Danish Knowledge Center for Food.

11. U.S. Department of Agriculture (2009) "Overview report of the benefit cost analysis of the national animal identification system - Animal and Plant Health Inspection Service" USDA Report.