Proceedings of the
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Animal Identification and Traceability
‘From Farm to Fork’

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Preface

Today, animal identification and traceability are important management tools in animal health and food safety. In many countries, the traceability of domestic animals and of products of animal origin is a legal requirement and it is also a key element supporting credible international health certification.

In its capacity as a leading international standard-setting organisation for animal identification and traceability, the World Organisation for Animal Health (OIE) helps its Member Countries and Territories to implement animal identification and traceability systems in order to improve the effectiveness of their policies and activities relating to disease prevention and control, animal production food safety and certification of exports. The OIE first addressed the issue of traceability in 1998 at the international seminar ‘Permanent Animal Identification Systems and Traceability from Farm to Fork’, in Buenos Aires, Argentina. In 2001 the OIE dedicated an issue of the OIE Scientific and Technical Review to the issue of traceability. In 2005 an ad hoc expert Group was established and, in May 2006, OIE Members democratically adopted a Terrestrial Code chapter: General Principles on Identification and Traceability of Live Animals as an official OIE standard. This chapter was updated in 2007. In May 2008, at the 76th General Session, the General Assembly of the 172 National Delegates adopted a text on the design and implementation of identification systems to achieve animal traceability.1

Bearing in mind the need to coordinate the development of standards for identification and traceability of both animals and products and to build a bridge between them, the OIE has maintained close collaboration on this topic with the Codex Alimentarius Commission (CAC), which, like the OIE, is a reference standard-setting organisation recognised by the World Trade Organization. Just as the OIE is the reference organisation for animal health and zoonoses, the CAC takes primary responsibility for food safety. The OIE and the CAC collaborate closely in the development of standards relevant to the food production chain, including those for identification and traceability of animals and animal products. The conference is being organised with the technical collaboration of experts involved in the work of the CAC.

This conference, which is the first of its kind, gives participants a unique opportunity to learn about relevant techniques and discuss experiences of both developed and developing countries and international organisations, including donors supporting the improvement of national veterinary services. High-quality presentations from senior representatives of governments and private sector organisations, including producers, retailers, consumers and scientific research organisations, will form the basis for interactive discussions between presenters and participants. The conference also provides a forum to discuss OIE Members’ priorities in this domain, including for capacity building to support the implementation of the current OIE and Codex standards and the possible future need for the elaboration of new standards and research.

I am convinced that veterinarians and associated professions and partners have the knowledge, expertise and commitment to achieve the goals set for this conference. By working together, we can raise the profile of animal identification and traceability worldwide and encourage Veterinary Services, including veterinarians in the private sector, and their partners to play a proactive role in the implementation of animal identification and traceability.

Dr Bernard Vallat
OIE Director General


Proceedings of the First OIE Global Conference on Animal Identification and Traceability ‘From Farm to Fork’
Introduction

The identification of animals is a very ancient practice, and traditional livestock marking systems have existed for centuries. The main reasons for doing this were, of course, to enable the ownership of livestock to be established, to prevent stealing and misuse. All these reasons for livestock identification still exist today. However, our modern understanding of disease prevention and control, the implications of animal diseases and other pathogens for human health and food safety, and the increasing pressure on farmers to adopt responsible livestock production practices, mean that animal identification and product traceability systems are more important today than ever before.

The pillars of a traceability system are founded upon the identification of individual animals or homogenous groups of animals, the ability to track their movements and their use, proper identification of premises, and recording of this information in appropriate registers.

The earliest methods of identifying animals were simple systems such as hot branding, ear notching and tail tagging. However, with the progressive intensification of animal production, new tools have been developed to enable animal marking methods to meet new needs. Today, animal identification and traceability are key management tools in animal health and food safety. In many countries, traceability of live domestic animals and of products of animal origin is required by governmental authorities to protect public and animal health and give consumers an informed choice about products purchased.

In its capacity as a leading international standard-setting organisation for animal health and animal production food safety, the World Organisation for Animal Health (OIE) encourages its Member Countries and Territories to use animal identification and traceability systems in order to improve the effectiveness of their policies and activities relating to disease prevention and control, food safety and certification of exports.

Bearing in mind the need to coordinate the development and adoption of global standards for identification and traceability of animals and products, the OIE has maintained close collaboration on this topic with the Codex Alimentarius Commission (CAC), which, like the OIE, is a reference standard-setting organisation recognised by the World Trade Organization (WTO) in the SPS Agreement. The CAC takes primary responsibility for food safety, and the OIE for animal health including zoonoses, and live animal identification. The OIE and the CAC collaborate closely in the development of standards relevant to the food production chain, including those for identification and traceability, and the bridge between live animals and products.

This paper provides an overview of the OIE’s work in setting standards on animal identification and traceability, and identifies the objectives and expectations for this, the first OIE conference on a topic that is key to the efficiency of the work of Veterinary Services and their partners worldwide.

Discussion

The OIE first addressed the issue of traceability in 1998, at the international seminar ‘Permanent Animal Identification Systems and Traceability From Farm to Fork’, held here in Buenos Aires, Argentina. In 2001 the OIE devoted an issue of its Scientific and Technical Review to traceability (2). In 2005 an ad hoc expert group was established, and the OIE International Committee (the General Assembly of all National Delegates) adopted texts entitled ‘Guidelines on identification and traceability of live animals’ (3) and ‘Design and
Introduction

implementation of identification systems to achieve animal traceability’ (4), in May 2007 and 2008 respectively. The OIE’s sister standard-setting organisation, the CAC, has developed a standard entitled ‘Principles for traceability/product tracing as a tool within a food inspection and certification system (CAC/GL 60-2006)’ (1). The OIE and the CAC have taken care that these standards were developed in a manner that ensured consistency and that avoided gaps and duplications.

This brings us to 2009. The OIE is holding this conference to help Members and participants understand the latest information and technologies, and implement modern systems for animal identification and traceability. This is an unique international forum, where the experiences of the public and the private sector in creating, improving and implementing identification and traceability systems will be presented. Participants will have the opportunity to discuss needs and tools on a regional and national basis, and the possibilities for securing investments in reinforcing the efficiency of veterinary services and their infrastructure as required. This is particularly important for the developing and in-transition countries that comprise a large proportion of the OIE’s 174 Members.

Stakeholders sometimes ask, ‘Why should we have systems for animal identification and product traceability?’

Central to the original mandate of the OIE, animal identification helps producers and the institutions that support them to manage animals more effectively, to implement herd/flock health programmes and to apply more efficient breeding or genetic improvement programmes. Whether in response to disease outbreaks or in the context of disease prevention, traceability is important to countries wishing to establish measures, including for surveillance, early detection and notification of outbreaks, rapid response, control of animal movements, and zoning or compartmentalisation. Zoning and compartmentalisation offer benefits to countries that cannot eradicate serious diseases on a national basis. However, effective identification and traceability systems are required to implement both zones and compartments.

With regard to food safety, traceability can help to prevent food contamination incidents and to respond promptly and effectively in the event of a crisis, with the key benefit of maintaining consumer confidence. Furthermore, it can help to eliminate unjustified trade barriers, because a sound traceability system provides trading partners with assurances on the safety of the products they import. Traceability techniques can provide additional guarantees as to the origin, type and organoleptic quality of food products, and are of great assistance to countries negotiating market access for animals and their products.

For food products traded internationally, it is an important goal to harmonise national standards for identification and traceability and the bridge between live animals and their products. This goal can be usefully promoted by basing national systems on the international standards of the OIE and the CAC.

In wealthy countries, consumers may be interested in characteristics of food production systems that are not directly linked to food safety, such as ethical practices, animal welfare, environmental impact/sustainability, genetically modified food, and food derived from cloned animals. In some countries there is growing demand for production schemes that offer various characteristics, such as organic, free-range, local origin and low ‘carbon footprint’. Where relevant food-labelling schemes exist, traceability systems are essential for credibility. However, we must not forget that in many regions of the world, there is a basic and pressing need for high-value protein, which must be obtained from safe products of animal origin. The costs associated with identification and traceability systems must
be carefully balanced against the benefits, to ensure that appropriate systems can be implemented in all countries.

The production of aquatic animals in aquaculture systems is growing steadily, and aquaculture products are an increasingly important source of high-value protein globally. Identification and traceability of aquatic animals poses some particular technical challenges. However, the same basic principles apply.

In developing and implementing identification and traceability systems, it is important to establish a bridge between live animals and their products, based on a seamless system throughout the animal production and food chain – from farm to fork – respecting the standards of the OIE and the CAC.

As with other key activities of the Veterinary Authority and its partners, it is important to establish a national legal framework for the implementation and enforcement of animal identification and animal traceability within the country. This legal framework should address several elements, including the objectives, the scope, the animal species involved, the organisational arrangements – including the choice of technologies for identification and registration – the obligations of the parties, confidentiality, penalties, information accessibility issues, methods of information exchange and equitable means for financing programmes. The OIE and the CAC recommend that legal frameworks be developed in consultation between relevant governmental administrations or agencies and the private sector, including beneficiaries and stakeholders.

Many factors have a bearing on the design of animal identification and traceability systems at the national and regional level. Relevant factors at the national level include the animal and public health situation in the country; animal population parameters (such as species and breeds, numbers and geographic distribution); types of production; animal movement patterns; available technologies and their cost, the organisation of trade in animals and animal products, and the priority species and sectors to be addressed. These factors are also relevant at the regional level, and additional factors, such as the historical trading relationships between countries, the respective disease status of countries, the capacity to apply border controls, and the goals of the traceability systems, also apply at this regional level. The design of animal identification and traceability systems should take account of the costs and benefits of different models, as well as economic, geographical and environmental considerations and, importantly, societal and cultural aspects. However, it is clear that adoption of identification and traceability systems will continue to gain importance for all countries in order to support global market access for animals and their products.

The OIE and Codex standards are outcome based; different systems can be used to achieve equivalent outcomes. Flexibility in the approach to implementation means that the standards are broadly applicable by member countries and territories according to their socioeconomic circumstances.

The objectives of this conference are to inform participants of the importance and benefits of identification and traceability; to raise awareness of existing OIE and Codex standards; to determine future requirements for standards and for applied research in this field; and to provide advice and encouragement in implementing standards, especially for developing countries. Our partners from the private sector will also provide the latest information on relevant technologies in the poster room.

At this conference we have about 500 participants, who come from partner international organisations, national administrations, the private sector, including farmers and processors,
consumer organisations, and animal research and production groups. Our speakers come from countries that are leaders in the implementation of traceability systems, as well as from developing and in-transition countries, where there is a pressing need for practical, cost-effective solutions to animal identification and traceability. We will hear presentations covering all sectors and livestock species used for food production, different technologies and tools for identification and traceability that are currently available, developing countries’ perspectives on needs and tools, and the responses of international donors and capacity-building organisations.

We also need to look to the future and to assess the needs of humanity in the years to come. The global population is estimated to reach 9 billion by 2050. Pastures, agricultural land and forests are threatened by urbanisation and public facilities such as roads and recreational areas, as well as by non-food crops used for biofuels or to produce textiles.

According to some experts, the global demand for animal protein (milk, eggs, meat) is likely to rise by 50% by 2020, even though the economic growth of recent years is now stabilising. In addition to the increase in the world’s human population (principally in developing countries), this growing demand will come from hundreds of millions of poor households joining the middle classes in emerging countries.

The only way to meet this worldwide demand for animal protein is by intensifying livestock production. This will lead to increased sanitary and environmental risks, which cannot be effectively controlled without increasingly strict regulations, including for animal identification and traceability. Veterinary Services must have the resources to develop and implement appropriate disease prevention and control programmes, and the power to enforce them. Farmers and operators all along the food chain must be informed of the benefits of identification and traceability, and motivated to comply with the programmes implemented by the governmental authorities.

In addition, the use of biotechnology and cloning in animal production will create a need for new methods and systems to trace animals and products. Given the variety of reproductive technologies and modes of genetic transmission currently available commercially, the tracing of biotechnology-derived animals and their offspring presents new problems. Under certain circumstances, authorities may have to trace every individual animal and animal product derived from a novel production method. New technologies may also offer solutions. For example, DNA identification makes it possible to identify and trace animals and animal products through to the retail level. Nonetheless, whether a system uses sophisticated technology or simple methods such as ear tags and paper-based records, the principles of traceability as defined by the OIE and the CAC are universal and applicable in all situations.

**Conclusions**

A traceability system is an essential tool for controlling disease, managing livestock production and ensuring food safety and quality. To be fit for this purpose, a traceability system should enable an animal product to be traced back to the animal’s farm of origin and to be identified throughout the food production chain. Traceability constitutes the bridge between animal health, food safety and the organoleptic characteristics of food linked to its origin. Ultimately, the major benefits to be derived from traceability relate to safe food and consumer confidence, both of which contribute to the long-term sustainability of livestock production. Veterinary services and their partners in the public and private sectors play a key role.
I am confident that this conference will meet its main objective, which is to help countries to progressively implement effective traceability systems that are compatible with their socioeconomic circumstances while respecting the standards of both the OIE and the CAC.

Dr Bernard Vallat
OIE Director General

References


Session 1

Benefits of animal identification and traceability

Chair: Dr María Silvina Tirabassi
Director General of Argentina’s Customs

Objectives: to outline the benefits of identification and traceability

Animal health including zoonoses
Disease prevention and control
Food safety and quality
Consumer confidence
Preventing fraud
Genetic improvement
Trade
Animal production and distribution management efficiency
Crisis management
Animal identification and traceability systems: benefits and importance – a personal perspective

P.J. Rogan
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Summary

A major food safety incident, particularly where the potential effects may arise in a number of countries, brings into sharp focus the issue of food traceability.

Effective food safety programmes must include food chain traceability, which is itself predicated on and driven by effective animal identification systems. The animal identification system when first developed may have had a number of intended outcomes, other than food safety, such as determination of ownership, routine animal health management at individual farm level, animal disease control programmes at local, regional, national and global levels, enhanced breeding programmes and ultimately ensuring market access.

It is no coincidence therefore that the positioning of the design and implementation of animal identification systems is given such priority in the OIE Terrestrial Animal Health Code 2008, appearing as it does in Chapter 4.2.

Ultimately the major benefits to be derived from an OIE-based animal identification system are enhanced food safety and greater consumer confidence in the livestock products placed on the market place.

The implementation of an internationally acceptable animal identification system, such as that developed by OIE, provides additional credibility to a national programme, as potential trading partners, particularly those who are Member Countries of OIE, will be familiar with and have contributed to its development through their participation in the General Assembly of OIE delegates.

Despite the implementation of internationally accepted animal identification and traceability system there are however gaps between consumer expectations of what traceability means to them, the intent of regulators and the systems developed by the food industry to deliver traceability.

International organisations in attempting to forge definitions that will withstand a variety of external pressures, are faced with the fundamental obstacle of translating lofty aspirations into market place reality, where balancing what is technologically attainable with what is achievable at a practical level, while not adding unjustified cost to the basic consumer food basket.

Food chain traceability is primarily a risk management tool that is intended to play a part in enhancing food safety and consumer protection, through processes that allow for the tracking of potential risks throughout the food chain, while at the same time tracing the source of the potential risk back to the live animal, to ensure its elimination.

Difficulties in the application of the tool can arise depending on whether the criteria laid down are prescriptive or generic. The European Union General Food Law establishes the basic principle of traceability being a ‘one step forward and one step back’ process, which should allow the benefits of the implementation of OIE standards to be achieved.
Keywords: Animal disease – Food safety – International standards – Protectionism – Simple systems.

Stop a consumer pushing a trolley through the aisles of a supermarket and pose the question: ‘Do you believe that food traceability is important to guarantee the safety of food?’ Needless to say the response will be ‘Absolutely.’

If you then ask another question, ‘Should the consumer have to pay more for food that has guaranteed traceability?’ the answer will be a most emphatic, ‘No!’

Pick a food item out of the trolley and ask the consumer, ‘Would you purchase this item if it was not traceable?’ The consumer’s facial expression provides the answer, ‘Of course not. Do you think I’m stupid?’

Before supermarket security personnel come to detain you, you get to ask one final question, ‘What does traceability mean to you?’ Chances are the only response will be a shrug of the shoulders.

Change the location and pose the same questions to representatives of government agencies, regulators, food safety specialists, food industry managers and food retailers. The responses will be different, but couched in broadly similar terms:

‘Traceability is an essential component of safe food production.’
‘But of course the costs of traceability are factored into the cost of the final product,’

or alternatively:

‘Traceable safe food costs more to produce and this is passed onto the consumer.’
‘As a retailer I demand traceability from my suppliers.’
‘Traceability is vital in order to protect the retailer, it’s all about product liability.’

The most difficult question, and the one for which there is no single or simple answer, is:

‘What does traceability mean to you?’

Without a doubt each of the delegates present at this global World Organisation for Animal Health (OIE) conference has in their own mind a clear picture of what traceability means to them, in a process that starts at the livestock producer level inside the farm gate, proceeds through animal slaughter and processing, storage, and distribution to the supermarket shelf, and finishes in the consumer’s refrigerator or on the table.
Since we now live in what can be described as a global supermarket, with foods of animal origin on offer from all parts of the planet, we have to devise and implement food traceability systems that are both understandable and readily applicable. If it is accepted that the end point of traceability is the provision of assurance to the consumer of livestock products, then the starting point of the whole process must be focused on effective animal identification and traceability.

When originally developed, animal identification systems may have been limited to establishing animal ownership at a very local level in order to resolve disputes between herdsmen and neighbouring villages. Egyptian tomb paintings from 4,000 years ago show cattle being branded. In 1537 a stockmans' association was established in Mexico. Each stockman was required to have his own cattle brand (4). In parts of the world ear marking is still used as an effective cattle identification system today (2).

Such systems were simple, and based on marks applied to the hide or skin of the animal, using dyes or paint, brands, or perhaps even incisions or excisions. An essential element of even the simplest system of animal identification is that the marks used are associated with a particular individual, thus establishing ownership of and/or responsibility for the animal involved.

As we attend this conference in Buenos Aires there is ongoing conflict in Sudan in which over 200 people have been killed. The conflict has its origins in a dispute over the ownership of cattle.

In moving from the very local situation to either a regional or national market, the basic principles of ownership and responsibility continue to apply, but additional elements become necessary. These include a record of the type of marks that are in use, a record of the link between the marks already in use and the individual who has used them, and perhaps even a template for other marks that could be used by new owners or herdsmen in the future. Even at this level what is involved is the start of an animal identification and traceability system.

No matter how simple the animal identification systems may have been when first developed and implemented, the benefits to be derived from their use and their potential to play a part in so many other areas of livestock production are obvious.

From time immemorial when attempts to improve animal productivity through selective breeding were implemented, the importance of individual animal identification to ensure that the improvements obtained could be assured and maintained became evident. (In the late sixteenth century, Hermán Cortès when experimenting with cattle breeding used individual animal identification. The brand consisted of three Latin crosses.)

Over time and with livestock production becoming more organised, and as trade in live animals started to become a reality, the need for and the benefits to be derived from animal identification systems started to feature as part of that developing trade.

One of the downsides to the movement of and trade in live animals, within countries but more importantly when trade takes place across frontiers, is the relative ease with which animal disease can spread. All delegates at this conference are only too well aware of and have very likely had to deal with the consequences of animal trade and movements across frontiers, outbreaks of new and exotic diseases, and the spread of existing diseases to new regions or animal species within their own countries.

Apart from any other possible application for animal identification systems, if we wanted to highlight what is probably the most important benefit they offer, it is as a tool for both the eradication of disease and the prevention of disease spread. In my view, it is not possible to
effectively control and/or eradicate animal disease in the absence of a properly functioning animal identification and traceability system.

It can of course be argued that properly functioning animal identification systems are expensive to develop and require investment in resources on an ongoing basis if they are to be effective. It is true there are costs associated with animal identification systems and that the costs can escalate depending on how sophisticated the system is, but are the alternatives sustainable? The cost of animal disease in terms of mortality, increased morbidity, reduced fertility, premature culling and inability to trade in live animals and animal products must be measured against the cost of identification systems.

If you factor in the potential loss of trade in live animals and animal products, the economic considerations become highly significant and the loss of income, not just in the livestock industry, becomes readily apparent.

An example of the costs associated from an outbreak of exotic animal disease provides the best proof of just what is involved. In 2001 Ireland experienced a single outbreak of foot and mouth disease (FMD) in sheep, an outbreak that affected only a relatively confined region of the country, which due to its relative isolation provided somewhat simpler opportunities
for effective control of the outbreak. Even in the case of this single outbreak the cost to the exchequer was €210 million (4). Had the disease spread to the wider national herd an independent analysis estimated the total cost to the Irish national economy would have been €5.6 billion (4).

While geographical considerations played a part in the disease control and eradication process, the availability of an effective animal identification and traceability system was central to:

a) the rapid identification of all livestock at risk
b) the location of all susceptible species within the geographic region
c) the forward and backward tracing of all movements of susceptible livestock into and out of the region
d) the implementation of a highly effective animal movement control strategy, and
e) effective resource deployment.

Put very simply, in the absence of effective animal identification and traceability, Ireland would not have been in a position to eradicate the disease and regain its disease-free status in accordance with OIE standards (6) for a prolonged period of time.

As a trading nation with significant exports of both livestock and livestock products, it was vital for Ireland to quickly rebuild confidence in the health status of its national herd and the safety

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Figure 3 Some examples of brands
of its livestock products. The total value of beef and dairy product exports from Ireland in 2008 was in excess of €2.5 billion, and thousands of jobs are created and maintained through its livestock sector. This was what was at stake when FMD broke out in the country.

It is not sufficient however to expect that after a disease outbreak trading partners will accept verbal and/or written assurances of freedom from disease and the safety of both live animals and animal products. Statements of health status must be supported and be verifiable by reference to internationally accepted and recognised criteria, such as are found in the OIE Terrestrial Animal Health Code (the Code) (5).

If the Code is to be used as the basis for asserting health status, by reference to Article 8.5.8.1 of Chapter 8.5 – Foot and mouth disease – the assertions made must be underpinned by other elements of the Code.

Section 4 – Chapters 4.1 and 4.2 of the Code – details the various components of the design and implementation of identification systems to achieve animal traceability. These chapters, at pages 57 to 65 of the Code, can with justification be said to lay the very foundation for the Code itself, especially when we consider that the entire volume runs to 638 pages. It is not a coincidence that these two chapters appear so early in the Code.

Chapter 4.2 of the Code takes the reader through a limited number of articles, each of which lays out in some detail the different elements that can be used to develop an animal traceability system that is appropriate to meet both the needs of, and the resources available to, the particular Member Country. When using this chapter of the Code as a template for an effective animal identification and traceability system, the most significant benefits to be derived from the system are that it can be tailor-made to meet:

- the specific requirements of the veterinary service involved
- the needs of the particular industry sector
- the concerns and requirements of potential or actual trading partners
- internationally acceptable standards.

Central to the development of effective animal identification and traceability systems is the direct involvement of and commitment to the process by the different stakeholders in the country involved. While the veterinary authority in the country may be very well aware of the potential benefits of effective animal identification systems, it is only with the commitment of animal keepers and industry representatives to the development and maintenance of the system that there is any prospect of success. The imposition of a ‘top-down’ system by government and veterinary authorities will quite simply not work unless the farmers and the livestock industry in general both understand what is involved and are prepared to work with the veterinary administration.

While the ultimate goals of animal identification systems may be market access and food traceability, the OIE model allows for the development of an incremental system, which can over time be further developed to meet a number of desired outcomes.

For a Veterinary Authority that is seeking to develop animal identification systems that are robust and will withstand external scrutiny, there is another advantage to the use of the OIE template: those OIE Member Countries that have already developed their own systems have assisted in its development and in many cases eliminated or at least mitigated some of the stumbling blocks that might otherwise arise.

When using the OIE template it is not a question of reinventing the wheel, but rather the type of accessories you are going to put on the bicycle. If all that is needed is a simple system
to take you to the local market, there is no need to invest in a racing bike for the Tour de France.

I have already referred briefly to the commitment of stakeholders such as farmers and industry to the development of animal identification systems, but even more critical is the role played by government. Governments provide the essential resources for veterinary authorities, whether the resources are human or financial. Equally importantly, it is governments that can provide the impetus for farmers and industry to come together to start the process of building the systems appropriate to the needs of the sector involved.

The OIE, through its regional commissions, can bring its reputation and international standing to bear in influencing governments to make the necessary investment in animal health, breeding programmes, disease control and ultimately market access.

If market access is the ultimate goal, then further building blocks must be added to the animal identification system that is in use. The system in use must be sufficiently adaptable to allow its use beyond the abattoir lairage. The adaptation of the basic animal identification system has to be reflected in and incorporated into a product tracing system that is itself an integral component of the inspection and certification system that will provide the assurances required to underpin global movement of and trade in livestock products.

Here again the role of internationally accepted and recognised systems comes into play. Codex Alimentarius has developed a set of principles that are intended to be used as a tool within an established inspection and certification system (1). With Codex Alimentarius and the OIE working in conjunction to enhance consumer protection, we have another example of international organisations complementing each other.

The European Union through its General Food Law (2002) takes a very similar approach in providing for its ‘one step forward, one step back’ approach to food product traceability. Further definition is to be found in Council Regulation 178/2002, which clearly defines the responsibilities of the food business operator for traceability. Fundamentally the EU approach is to protect the consumer and to ensure that deceptive marketing practices cannot distort the market.

It is currently very topical to talk about protectionism, in the context of the international economic recession and the very negative effects that the implementation of inward-looking policies could have, in terms of worldwide economic recovery.

The same could be said of developing countries when talking about animal identification and traceability systems. It is not reasonable to expect countries with limited resources to create costly systems that mirror those in the developed world as a prerequisite to market access. To do so is to deny those countries the opportunity to develop at an appropriate pace. If additional measures are deemed necessary in order to provide an acceptable level of protection for the consumer in the developed world, then it seems entirely appropriate that consideration be given to the transfer of both the required technology and expertise.

Within the European Union, livestock producers and consumers benefit from some elements of the existing identification and traceability systems, but other elements that add considerable additional cost at both ends of the food chain, such as insurance liability transfer and achieving competitive advantage at retail level, should be shown up as what they are.

A further development, which appears to ignore the move towards the harmonisation of standards at an international level, is the developing trend towards ‘private standards’. Private standards, which impose additional requirements on primary producers over and above those
in either the *Code* or EU Food Law, are focused on enhancing market share and competitive advantage. Can the additional measures contained in such standards be justified on scientific grounds, or are they based solely on marketing theory?

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Benefits of animal identification and traceability

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Summary

Farm animal identification and traceability are essential components of a ‘farm-to-fork’ approach towards animal health and food safety. This ‘farm-to-fork’ approach helps ensure that food production and distribution systems deliver safe food, at affordable prices, to consumers. In highly developed economies with complex food chains, they are indispensable to the smooth operation of the market. In the international market, they help to provide confidence to importing countries regarding the safeguards offered by exporting countries. In this regard, it is important to harmonise national systems with international standards, which, in the case of identification and traceability for animals and animal products, are the standards established by the World Organisation for Animal Health (OIE) and the Codex Alimentarius Commission.

In the absence of reliable identification and traceability systems, there are potential flaws in control systems which create important risks to both food safety and market stability. When these flaws are brought to light, inevitably there are damaging impacts on the credibility of control systems, and on consumer confidence and market stability. All parties have a strong interest, therefore, in ensuring that there are effective identification and traceability systems in place.

Reliable identification and traceability systems are the bedrock of effective animal disease systems. They are key components of good disease surveillance, and establish the ability to quickly and accurately track animal movements should the need arise. They are also necessary to encourage the required investment in disease eradication measures, and the protection of that investment. At farm level, they are invaluable components of good animal husbandry systems. Through identification and traceability, farmers can not only better identify disease patterns, but also more easily collect and analysis commercially important data on yields, feed conversion, fertility and so on.

As animal products are such a significant input to the food processing sector, identification and traceability systems for farm animals help ensure that input materials are safe and that any problems can be quickly traced to their source, including to the herd of origin. They also facilitate record keeping, stock controls and product differentiation. They assist food producers and retailers to fulfil their regulatory obligations and to protect their brand image and reputation.

Identification and traceability systems must nonetheless be cost-effective, workable and proportionate to the risks they seek to address. This includes taking account of the international health, trade and development dimensions.

Keywords: Animal disease – Food safety – Identification and traceability – World Organisation for Animal Health (OIE) standards.
The benefits of animal identification and traceability are clear. We need look no further than the Terrestrial Animal Health Code of the World Organisation for Animal Health (OIE) (2). Chapter 4.1 summarises these benefits neatly:

- the management of disease outbreaks and food safety incidents
- vaccination programmes
- herd/flock husbandry
- zoning/compartmentalisation
- surveillance
- early response and notification systems
- animal movement controls
- inspection, certification, fair practices in trade and the utilisation of veterinary drugs
- handling feed and pesticides at farm level.

The Codex, in its ‘Principles for traceability/product tracing’ (CAC/GL 60–2006), sets out a range of other advantages (1). It would be easy to get lost in a long discussion on the detail of these individual and collective advantages, but that would risk obscuring some very simple yet important concepts. First, reliable identification and traceability systems are essential to effective animal disease control, and thus to modern animal production systems. Second, food safety systems and the stability of consumer markets are equally dependent on such systems. Third, trade in live animals and animal products is very seriously compromised in their absence.

It is very opportune therefore to have this conference, which involves the key international standard-setting bodies responsible for animal health and food safety, the OIE and the Codex respectively. Their standards, especially in the area of identification and traceability, in turn will have a major impact on the conditions under which animals and animal products can be safely traded.

In the European Union, our approach towards animal identification and traceability has its origins in a number of key complementary objectives:

- the protection of animal and public health
- the creation of a single European market for live animals and animal products
- consumer information, crisis management and the prevention of fraud.

The role of identification and traceability in relation to improved animal health

The contribution of animal identification and traceability to better animal health is self-evident. Successful surveillance, control and eradication of animal diseases is much easier if there are effective identification and traceability systems in place.

In Europe there is a very high and uniform level of animal health. This was not always the case. Up until the early 1990s, the animal health situation was far from satisfactory. One of the major obstacles to progress was the absence of effective and coordinated Europe-wide efforts to curb animal diseases. In the absence of such coordinated efforts, it was very difficult for individual countries to make progress. Even with strict controls on movements of live animals and animal products, it is almost impossible to control and eradicate diseases if your neighbours are not making a similar effort.

The EU Member States agreed on Europe-wide efforts to tackle animal diseases. Ambitious targets were established and significant financial resources were invested. And, importantly, the respect of high animal health standards was made a condition for access to intra-Community trade. There was therefore a combination of political commitment, financial assistance
and trade incentives which together provided the impetus for major progress. Healthy and constructive competition was also created among Member States, which encouraged them individually and collectively to make the necessary efforts.

Today, the progress made in tackling animal health problems is evident. The key animal diseases, such as rabies, foot and mouth disease and classical swine fever, are either eradicated or under control. We have also proved that progress can be achieved quickly.

As an example, the most recent enlargement of the European Union to include ten new Member States was achieved without any compromise on the very high levels of animal health and food safety in the Union. The new States quickly adapted to the existing regulatory requirements and proved that, with the necessary support and effort, rapid progress can be made.

When it came to implementing the measures, ensuring identification and traceability was probably the single biggest contributory factor in this success story. You will find comprehensive provisions on identification and traceability in all of the key animal health legislation in the European Union. This ensures that the localisation and tracing of animals for veterinary purposes is possible.

Probably the best example relates to the identification and traceability of live bovines. The European Union legislation requires that all live bovines are double ear-tagged, have individual passports, are entered in the herd register of the farmer, and are in turn registered on a centralised database maintained by the competent authority.

All movements of these animals are noted as they move through the production chain. This allows very accurate tracing and the system works to a very high level of efficiency. Regular controls are carried out both by the Member States’ Veterinary Services and by the European Commission’s services.

Enforcement is helped by the important penalties incurred for infringements. These can and sometimes do include destruction of animals that are found not to be registered.

We will shortly be introducing ambitious new traceability requirements in relation to sheep. A significant difference is that the passage of time has allowed us to make much better use of electronic identification for the measures which will apply to sheep from the beginning of 2010.

**The benefits in terms of food safety**

The example of the trade in beef provides an opportunity to outline another area where the benefits are evident: food safety. The traceability system I have briefly outlined does not stop at the slaughterhouse but continues throughout the retail chain. Labelling of beef cuts in Europe includes reference numbers which identify the slaughterhouse or origin, the animals concerned and the place where they were born, reared and slaughtered.

In essence, therefore, when Europeans speak of a farm-to-table approach they really mean it. This bridges the gap between animal health and food safety, ensuring that we have a system in place which is multi-functional.

This comprehensive system clearly requires a huge investment by all parties, especially farmers themselves. It is important that the investment is worthwhile and that it represents value for money. In turn, this requires a continuous reappraisal of the costs and benefits.

Critics of our approach will point to the motivating forces, and in particular the impact of bovine spongiform encephalopathy (BSE). It is of course true that BSE did drive the process. In a matter of months the European Union went from a relatively rudimentary system to the highly sophisticated system we have today.
That change was fundamental to the restoration of consumer confidence in the safety of beef. Consumption had fallen by almost half at the height of the BSE crisis. Only when consumers were reassured that the measures were in place guaranteeing the source of beef did demand for beef recover. Today, BSE is no longer a consumer concern.

Nonetheless, there is no significant demand to turn the clock back and reduce the levels of traceability and identification currently in place. Certainly there are demands to keep the costs to a minimum, but there are no pressures for a fundamental review. Instead the emphasis is on finding more efficient ways of identifying and tracing animals. This includes in particular making better use of modern electronic identification and tracking systems.

European producers, consumers and retailers have not only learned to live with the current requirements, they now consider them as non-negotiable features of our animal and food production systems. The benefits are seen to extend beyond animal health to include also the protection of human well-being. Consumers are reassured that products can rapidly be traced throughout the food chain in the event of problems. Food manufacturers and retailers similarly see identification and traceability as key components of their safety and quality assurance systems.

It is important in this respect to keep in mind that identification and traceability now extend throughout the food chain in the European Union. EU legislation includes a range of requirements for foodstuffs in general. As livestock products are such an important component of overall food production, this requires in turn that there is a clear trace of their origin and movements.

This has proved its use repeatedly in keeping to a minimum the problems that arise when there are food safety problems. In such cases, products can now be traced much more quickly and withdrawn from the market. However, traceability is also growing in importance for reasons which have nothing to do with food safety or animal health. It is also valuable for stock control, the monitoring of marketing trends and identification of consumer preferences, among other purposes.

Producers can benefit from these developments. Take the example of poultry sales in Europe. It is possible to buy a standard broiler chicken for as little as two or three euros. However, people can also pay several times more for a very high-quality bird such as a poulet de Bresse, a renowned French speciality chicken. And in between they can choose from a range of other consumer-driven preferences such as organic, free-range, 100% grain-fed and welfare-friendly birds, among many others.

However, this is only possible with rigorous and reliable identification and traceability systems. Retailers increasingly insist on such systems, and there is an increasing trend on their part towards supply systems where origin is both known and assured.

This trend is growing in response to consumer preferences in relation to sustainability, environmental and social demands. In many cases these demands arise from the grassroots without any intervention by public authorities. They are increasingly causing tensions, as such demands can represent barriers to trade, especially for developing countries. It is no coincidence that the issue of such unofficial standards is of increasing importance to both the OIE and the Codex. The main concern is that they are often unscientific and are put in place in a non-transparent manner without any input from the public authorities.

The trade dimension within Europe

It is interesting to look at the European experience in a trade context. Clearly, circumstances differ and animal health systems must reflect this. Some of these differences make animal disease controls easier, while others work in the opposite direction.
The very intensive nature of much of animal production in Europe carries important risks. Outbreaks of major animal diseases can have devastating consequences where there are large concentrations of animals. It is essential that there are good identification and traceability systems in place to keep these risks to a minimum. Such systems are essentially an investment or insurance policy to avert or reduce the risks of disease outbreaks. Like all insurance policies, they appear like a luxury or an unnecessary expense when times are good, but when there are outbreaks they prove their worth.

Similarly, the high level of movements of live animals both within and between Member States also carries risks. These movements reflect significant economic, climatic and even geographic factors. There are especially significant movements of animals from northern to southern Europe. Again, these can only take place on a safe basis if there are effective traceability systems in place.

**The international trade dimension**

An interesting feature of the European approach is that Europe continues to import quite significant quantities of animal products from third countries, even though identification and traceability systems in these third countries differ significantly from the European Union’s. The European Union has accepted that it can continue to import safely, but this has raised questions in Europe.

The EU response is to look to the overall level of controls, of which identification and traceability is a key control but not the only one. For example, deboning and maturation of beef can offer additional safeguards in relation to foot and mouth disease which need to be taken into account in making the overall assessment on the safety of imports.

Nonetheless, it is the case that weaknesses in identification and traceability systems, with the resulting difficulty of movement controls, are probably the biggest single irritant in relation to imports of fresh meat products. How can the European Union’s trade partners address this problem?

The European Union does not expect trade partners to replicate the EU approach, which is not necessarily appropriate to their conditions. However, it does believe that more could be done to better identify and trace those animals that are destined for EU markets. Electronic identification offers real prospects in this direction.

In addition, farmers have to be offered greater incentives to meet the particular requirements of European markets. It is the European Union’s experience that exporters are too often interested only in sourcing their animals at the lowest possible costs. They are not prepared to pay a premium for animals that meet European requirements. This is a big risk for them to take. For a relatively small investment, access to lucrative European markets could be secured or maintained on a more stable basis.

The competent authorities need to play a central role. The European Commission still counts on the competent authority to ensure compliance with our import requirements. It must take the lead in putting in place these requirements, including identification and traceability. In many respects this is a public good. Clearly the private sector’s cooperation is essential, but ultimately a truly successful approach needs a public lead.

**New challenges and opportunities**

It is an irony that identification and traceability are seen by many as obstacles and a problem. The reality is that they should be seen as a major opportunity to equip our animal health and
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production systems to play their full role in meeting our society’s many needs. The international standard-setting bodies should play their part in making this ambition a reality.

Certainly, challenges remain and the European Union remains vigilant to new risks. The spread of bluetongue to northern Europe is a painful reminder of the need to avoid complacency.

Nonetheless, it is clear that the disruption that has arisen as a result of bluetongue would be far, far greater in the absence of the sophisticated movement controls that are currently in place. These movement controls would be unworkable without the supporting identification and traceability systems.

Other diseases, like West Nile fever and highly pathogenic avian flu, also present new and important challenges. We are alert to these risks. Already there are a range of initiatives under way to update and strengthen our animal health systems.

This includes the European Union’s Animal Health Strategy. Identification and traceability systems will however remain central components of our animal health strategy. We will be looking at how we can use new technologies to make them work more effectively.

It is very important that the OIE and Codex are ambitious in dealing with identification and traceability. It is a big mistake to assume that the absence of international standards reduces the potential for national standards to create trade barriers. On the contrary, in the absence of international standards individual countries have freedom to adopt their own measures with few restraints. This is ultimately bad for trade.

More importantly it is also bad for animal and public health protection. In an increasingly integrated world economy, faced with significant new challenges like continued world population growth and climate change, we need global standards which provide a high level of protection. This must include identification and traceability.

The European Union and its Member States therefore would like to see ambitious conclusions emerging from this conference, which we would hope would put these issues very high on the agenda of our shared efforts to promote improved animal and public health protection at the global level.

The recently agreed OIE chapters on animal identification and on the design and implementation of systems to achieve such identification already provide a solid foundation on which to build. The Codex also has a key role to play, notably in the Codex Committee on Food Import and Export Certification and Inspection (CCFICS). The CCFICS recently suspended further work on guidance on traceability while discussions are held in the Regional Coordinating Committees on the need for such guidance.

It is hoped that the Regional Coordinating Committees will take a constructive approach towards this invitation. Traceability is a modern-day reality. Traceability is already hugely important for access to markets, and its importance will increase. Traceability systems will be driven primarily by markets and the demands of consumers and retailers in both domestic markets and international trade. Regulators, at both the national and multilateral level, must engage constructively in ensuring that these trends deliver real benefits for society.
So to conclude, a number of very brief points on the European experience with identification and traceability:

- identification and traceability systems deliver very real benefits in terms of animal health and food safety
- identification and traceability systems greatly assist trade
- identification and traceability systems are growing in importance, and this trend is being in large part driven by the private sector and consumer and retailer demands
- it is a mistake to view identification and traceability systems as a problem. Instead we should look to the real opportunities they provide to improve our animal production systems and to bring further benefits to society
- regulators, at both the national and multilateral level, must be positive on the potential of identification and traceability systems
- the OIE and Codex have a responsibility to lead this process at the multilateral level.

References

Session 2

International standards

Chair: Dr Sarah Kahn
Head, International Trade Department, OIE

Objectives: to present global standards on identification and traceability

OIE Standards
- General principles
  The design of identification systems to achieve animal traceability

CODEX Standards
- Principles for traceability/product tracing as a tool within
  a food inspection and certification system
Summary

A technical item on animal identification and traceability was presented at the 72nd General Session of the OIE in May 2004, at which time Members asked the OIE to develop standards on this matter.

Accordingly, the OIE Director General formed an ad hoc Group on animal identification and traceability, which has been working on the basis that these standards are an important tool for managing animal health and zoonotic diseases and for facilitating trade, as well as for preventing and controlling health crises. The ad hoc Group comprises experts from different regions of the world, and in its work it takes into account Codex activities to ensure proper coordination and complementarity between OIE and Codex standards.

When drawing up draft standards, the group has sought to ensure that the standards are fully applicable in the field, are compatible with the varying economic and technical capacities of OIE Members and are non-discriminatory.

Based on the ad hoc Group’s work and subsequent consideration by the OIE Specialist Commissions, the International Committee (the annual general assembly of national representatives of the OIE’s 172 Member Countries and Territories) adopted general principles and recommendations on the design and implementation of identification systems to achieve animal traceability (see Chapters 4.1 and 4.2 of the Terrestrial Animal Health Code (‘the Code’).

In the development of standards it has also been necessary to define terminology to prevent ambiguity of meaning. For the purposes of the Code, ‘animal identification’ is defined as ‘the combination of the identification and registration of an animal individually, with a unique identified, or collectively by its epidemiological unit or group, with a unique group identifier’. ‘Animal traceability’ is defined as ‘the ability to follow an animal or group of animals during all stages of life’.

These Code texts are the key international references relevant to the development and implementation of animal identification and traceability systems. Members of the OIE and Codex are encouraged to implement systems that comply with these standards as a basis for protecting animal and public health and facilitating international trade.

The OIE decided to hold this first global conference on animal identification and traceability to improve its understanding of what is happening around the world at present and to support members in applying the international standards. As a result of the conference, the OIE will assess whether additional guidance, tools or standards are required.

Keywords: Codex standards – Compatibility – Complementarity – Coordination – World Organisation for Animal Health (OIE).
Introduction

As is customary in the World Organisation for Animal Health (OIE), its work in developing standards for animal identification and traceability began with a scientific review of its Members’ needs to enable the OIE to comply fully with its objective of improving animal health worldwide.

In preparation for the submission of a technical item on identification and traceability to the OIE’s 72nd General Session in May 2004, a questionnaire was sent to all OIE Member Countries. Among the recommendations that emerged from the questionnaire, which were subsequently adopted by the World Assembly of Delegates, was that the OIE should draw up standards on identification and traceability.

The Director General of the OIE formed an ad hoc Group on Animal Identification and Traceability, which has been working on the basis that these standards should serve as a tool for managing animal health, zoonoses and trade, as well as for controlling animal health crises. The ad hoc Group comprises experts from different regions of the world, and in its work it takes into account Codex activities in order to ensure proper coordination and complementarity between OIE and Codex standards.

In drawing up draft standards for the Terrestrial Animal Health Code (Terrestrial Code), the Group has sought to ensure that the standards are fully applicable in the field, and are compatible and non-discriminatory for the Member Countries.

The OIE has adopted and included in the Terrestrial Code standards relating to definitions of the most relevant terms. Section 4 of the Terrestrial Code, entitled ‘General recommendations: disease prevention and control’, includes Chapter 4.1 on ‘General principles on identification and traceability of live animals’ and Chapter 4.2 on ‘Design and implementation of identification systems to achieve animal traceability’.

Preliminary stages in the development of OIE animal identification and traceability standards

Identification and traceability have been used since ancient times, probably since animals were first used for human food and traction. Use of the concept has evolved in line with the growing intensiveness of animal production systems, which has made it necessary to have more information so as to increase production, improve genetic aspects and control certain diseases.

However, until the OIE began its work on standards, identification and traceability had never been used and implemented as part of a standardised process, even within a single country or zone. Methods of identification and traceability varied widely, from the definition of terms to the elements used for their practical implementation. In fact, the concept that some used to classify as animal identification was understood by others to mean what we now call animal traceability.

It could be said that one of the factors that spurred interest in cattle identification and traceability, at least in Argentina, was the bovine spongiform encephalopathy (mad cow disease – BSE) crisis that occurred in the United Kingdom and Europe. Two of the tools used to help control the disease were identification and traceability. These, together with scientific research, made it possible to implement the appropriate animal health strategies to fight BSE. The identification and traceability concept, in connection with the mad cow crisis, was discussed extensively in the public media for many months, and this helped to ensure familiarity with and adoption of the terminology used today.
A series of elements are required for implementing animal identification and traceability, including devices for identifying animals (2). In parallel with the theoretical debate, different types of identification devices are starting to appear on the market, including ear tags, microchip implants and electronic rumen boluses, and private sector suppliers of these devices are starting to pressure governments to implement identification and traceability systems, preferably by compulsion, but failing that, on a voluntary basis.

In Argentina in 1996, as a result of the growing discussion on the topic, a bill for the nationwide identification of all animals was presented in the National Congress. The bill also emphasised that there was a need for greater awareness about identification and traceability, which prompted the OIE and Argentina’s National Health and Agrifood Quality Service (SENASA) to organise a joint international seminar on animal identification and traceability, entitled ‘Del campo al plato’ (from farm to fork).

This event, which was held in the city of Buenos Aires in November 1998, was attended by world experts on identification and traceability, including the chief veterinary officers of Argentina, Australia, Brazil, Canada, the European Union, France, Germany, Italy, New Zealand, the United Kingdom and the United States, with 700 delegates from all over the world participating in the seminar.

The aim was to exchange experiences among countries that already had identification programmes at different stages of development. The objectives of each of the programmes were analysed. There were also discussions on the advantages and disadvantages of each of the animal identification devices on the market. This was supported by fieldwork that the European Union had begun to compare the different devices and the results from each in relation to a range of variables, including retention in the animal, legibility and ease of application.

**Scientific contribution from the OIE during the preliminary stages, OIE technical item at the 72nd General Session of the OIE and Scientific and Technical Review**

As mentioned in the introduction, in its desire to continue with the scientific development of this important issue, the OIE decided to include a technical item on ‘identification and traceability’ in its 72nd General Session in May 2004. To prepare for the item, the rapporteur, Dr Luis Barcos, together with Dr Daniel Chaisemartin, drew up and sent a questionnaire to the Member Countries (4).

The main purpose of the questionnaire was to gather information about the status of each country with regard to identification and traceability. This in turn was used to make an international analysis of: competent authorities with respect to regulations; registration systems; mandatory animal identification; animal identification objectives; elements used in animal identification; documentation used for transferring animals; harmonisation and standardisation procedures applied by the Member Countries; how animal identification and traceability relate to factors such as public health, animal health, trade and bioterrorism; the importance of economic aspects; and the OIE’s role in furthering the issue.

The responses to this questionnaire from 98 Members were extremely useful and provided the first-ever worldwide guide, which the OIE used for the future development of OIE standards in this field. An analysis of the responses revealed that there was increasing interest in animal identification and traceability, linked closely with such matters as disease control procedures, epidemiology tools, public health and trade. Most of the Member Countries agreed that the OIE should be responsible for developing international standards (1).
At the 72nd General Session, the World Assembly of Delegates adopted a resolution recommending that the OIE should set up an ad hoc Group to develop future standards on animal identification and traceability.

In addition, the OIE convened experts from different regions of the world to compile existing knowledge about animal identification and traceability in a special issue of the OIE Scientific and Technical Review. This publication was, and still is, extremely important as it provided a scientific basis for the discussion, development and implementation of standards in the Member Countries (3).

Work of the ad hoc Group and of the OIE specialist commissions

In compliance with the mandate of the World Assembly of Delegates, the recommendation of the OIE Regional Commissions for Africa and the Middle East and the recommendation of the WTO Committee on Sanitary and Phytosanitary Measures (SPS Committee), the OIE Director General convened an ad hoc Group comprising experts from all five continents and a Codex representative. The OIE Director General also directed the Animal Production Food Safety Working Group to draw up the terms of reference for the ad hoc Group on Animal Identification and Traceability, and these are listed below. The Working Group also recommended that Codex representatives should be invited onto the ad hoc Group to ensure that future standards on traceability of animals and animal products would be drawn up in a way that would ensure coherence between the OIE and the Codex.

The terms of reference for the ad hoc Group on Animal Identification and Traceability listed the following objectives:

1. Agree on key definitions.
2. Enumerate a set of principles for good live animal identification and traceability. These principles should be broad, be valid for all the relevant animal species and take into account the differences among OIE Members:
   a) compatibility among systems
   b) ability to transfer information
   c) cost benefit for all OIE Members.
3. Based on these principles, to lay out the main points that constitute a good system for identification and traceability of live animals and the outcomes required. These points should include:
   a) the minimum requirements for good animal identification and traceability
   b) the options available
   c) the advantages and the disadvantages of the various options.
4. Develop a set of recommendations for the practical implementation of the system. For practical reasons, this system should apply to bovine species first, with other species to be addressed subsequently.

The ad hoc Group comprises the following experts: Dr Luis O. Barcos (Argentina) (chair), Professor Hassan Aidaros (Egypt), Dr Yamato Atagi (Japan), Dr Tony Britt (Australia), Dr Annamaria Bruno (Codex), Dr Martine Dubuc (Canada) and Dr Musa Fanikiso (Botswana).

It was on the basis of this mandate that the ad hoc Group began work. It drew upon the support of members of OIE specialist commissions, such as the Code Commission and the Scientific Commission, because identification and traceability are considered as horizontal issues. The ad hoc Group’s documents were discussed at meetings of the specialist commissions and sent to the Members for comment as a first stage in drawing up the standards.
First the Members were sent a document containing the definitions and general guidelines (points 1 and 2 in the mandate above). After incorporating the Members’ comments, the World Assembly of Delegates adopted these first two points as standards at the OIE General Session of 2006, and subsequently they were incorporated into the Terrestrial Code.

After this, the ad hoc Group continued working on the next part of their mandate: to design identification and traceability systems, which were again submitted to the Members for their comments and proposals prior to adoption by the World Assembly of Delegates.

**Future stages of OIE animal identification and traceability standards**

The OIE Members have now democratically approved international standards that have been subject to the process described earlier, and not only incorporate the best scientific knowledge available worldwide but also conform to the specific requirements of Members on the basis on their comments.

The next stage after adoption of the standards is to apply them in the field. Their application is evaluated using the OIE PVS Tool (Tool for the Evaluation of Performance of Veterinary Services), which is designed to help the veterinary services to determine their state of progress and to identify any gaps or shortcomings in their ability to comply with OIE international standards.

The continuous updating of OIE standards is one of the routine procedures of the Organisation, and in future the standards could be expanded to cover all animal species and any new technologies that may be developed as a result of the Members’ interest.

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Codex Alimentarius standards, ongoing work and cooperation with the World Organisation for Animal Health (OIE)

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Secretariat of the Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme – Viale delle Terme di Caracalla, 00153 Rome (Italy)

Summary
The main purpose of the Joint FAO/WHO Food Standards Programme, which is implemented by the Codex Alimentarius Commission, is to protect the health of consumers and ensure fair practices in the food trade. The Joint Programme also promotes coordination of all food standards work undertaken by international governmental and nongovernmental organisations. To this end, the Commission, with 179 members and over 200 observer organisations, produces and updates the Codex Alimentarius or ‘food code’, comprising standards, guidelines and recommendations.

Work on traceability/product tracing has been carried out mainly by the Codex Committees on General Principles (CCGP) and on Food Import and Export Inspection and Certification Systems (CCFICS). The first has developed a definition, which was included in the Codex Procedural Manual in 2004 and the latter the Principles for Traceability/Product Tracing as a Tool within a Food Inspection and Certification System (CAC/GL 60-2006). The principles aim at assisting competent authorities in utilising traceability/product tracing as a tool within their food inspection and certification system, when and where appropriate, in order to contribute to the protection of consumers against food-borne hazards and deceptive marketing practices as well as the facilitation of trade on the basis of accurate product description.

In addition to this specific work, traceability/product tracing is explicitly or implicitly recognised in a number of other texts adopted earlier, in relation to product identification and recall procedures.

Currently there is no specific work ongoing within the Commission on traceability/products tracing. The Commission may consider the need for further work in the near future in the light of the experience of Codex members in the use of traceability/product.

Cooperation between Codex and the OIE is important in order to avoid duplication, gaps and inconsistencies in international standards that cover the areas of common interest. To ensure that OIE and Codex texts are consistent and that traceability/product tracing can be applied throughout the entire food chain, the experts with Codex background have participated in the relevant activities of the OIE including the ad hoc group on identification and traceability of live animals while the OIE has participated in the work of CCFICS and CCGP.

**Introduction**

Interest in traceability in food processing has been increasing among regulatory authorities in recent years, primarily because of the different crises that affected the food sector, such as the bovine spongiform encephalopathy (BSE) originating in the United Kingdom and the dioxin contamination originating in Belgium in late 1990s. Authorities have focused on traceability to ensure consumer safety, to enable the effective recall of defective/hazardous products and to investigate or identify the sources of problems. In a number of countries and regions, traceability/product tracing is also seen as a tool to substantiate particular food labelling or claims, or to aid in consumer information.

From an industry perspective, the application of traceability may offer a series of advantages and benefits. It allows different raw materials to be directed to production of different categories of product. It subsequently allows the company to determine whether the yield, quality or safety of a particular category was related to a particular raw material or a particular ingredient. In fact, a form of traceability is required for an Hazard Analysis and Critical Control Point (HACCP) system to be implemented. The record-keeping step of the HACCP system aims at documenting that the system is under control, and that corrective actions and recalls of unsafe products are undertaken when required.

Governments, food producers and food handlers each have their own incentives and tasks to document the flow of food products through production and distribution chains in accordance with national regulations, if any. The general objective of such systems is to identify, trace and effectively separate and/or remove specified products from the market as necessary.

**The Codex Alimentarius Commission**

The Codex Alimentarius Commission, ‘Codex’ for short, was created in 1961/1963 by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) to develop international food standards, guidelines and recommendations in order to protect the health of consumers and to ensure fair practices in the food trade. Another important role for Codex is to promote coordination of all food standards work undertaken by international governmental and non-governmental organisations, with a view to avoiding duplication of work between Codex and those organisations within the international normative activities. The constituency of the Codex Alimentarius Commission comprises 180 member countries and one member organisation (the European Community), as of March 2009.

The Codex standards and related texts adopted by the Commission constitute the Codex Alimentarius.

Codex is an international risk-management body that develops food safety standards. These are used by policy makers and regulators of countries in building a sound national food control system to provide safe food and to protect the health of consumers at national level. In a rapidly globalising world, it has become increasingly important for countries to be fully involved in the Codex standard-setting process.

The Codex standards and related texts enjoy privileged status as international reference points for harmonisation under the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) as regards food safety, and under the Agreement on Technical Barriers to Trade (TBT Agreement) as regards all matters other than food safety, such as food labelling. In particular, the link between the SPS Agreement, Codex and the OIE calls for coordination of work between Codex and the OIE, especially in guaranteeing the safety of products of animal origin.
Codex work on traceability

The FAO Conference on ‘International Food Trade Beyond 2000: Science-Based Decisions, Harmonization, Equivalence and Mutual Recognition’ (Melbourne, October 1999) recognised that traceability was an important control factor in the production of foods (27). As the follow-up of this Conference, the 49th Session of the Executive Committee (October 2001) discussed how to address the general issue of traceability in the framework of Codex, and recommended that the Committee on General Principles consider the following aspects of traceability: as a food safety objective (i.e. as an SPS measure); and as a legitimate objective (i.e. as a TBT measure). The Executive Committee agreed that the committees concerned (including the Committees on General Principles, Food Import and Export Inspection and Certification Systems, Food Hygiene and Food Labelling) should undertake work as they deemed appropriate within their mandates (20).

Following the decision of the Executive Committee, work on traceability/product tracing started, with the greater part of the task being undertaken in the Committees on General Principles (CCGP) and on Food Import and Export Inspection and Certification Systems (CCFICS), which respectively developed the definition and the principles for traceability/product tracing.

The definition

The 16th Session of the Codex Committee on General Principles (2001) highlighted the importance of the issue and the need for a uniform approach to the concept and application of traceability. Delegations and observers of the CCGP believed that it was important to include the place of traceability in risk management; the use of traceability for product integrity, authenticity and identification; the use of equivalent measures; the practicability of traceability, and in particular the feasibility of its application in developing countries; consumer confidence and information concerning the nature and origin of products; and the possibility of using traceability to establish liability and obtain redress (19).

Extensive discussions at the following sessions of the CCGP resulted in the elaboration of a definition of ‘traceability/product tracing’ for Codex purposes (see below), which was adopted by the 27th Session of the Codex Alimentarius Commission for inclusion in the Codex Procedural Manual (17). When adopting the definition, the Commission also requested the CCFICS to start new work on principles for the application of traceability/product tracing as a matter of priority (21, 22, 23, 24). The definition adopted was:

Traceability/product tracing: the ability to follow the movement of a food through specified stage(s) of production, processing and distribution.

The definition is worded so as to allow it to be used flexibly throughout Codex texts. For example, it does not specify the person(s)/organisation(s) that have this ability to follow the movements, and thus allows specific guidelines, when drafted, to provide for this information. Additional flexibility was given by using the wording ‘through specified stage(s) of’ in order to take into account the specific conditions of the primary production sector in developing countries, recognising that detailed guidelines for specific applications would have to deal with this issue.

The CCGP considered that the definition of traceability developed by the International Organization for Standardization (ISO) (namely, the ‘Ability to trace the history, application or location of an entity by means of recorded identifications’, ISO 8402: 1994) was not appropriate for use in Codex. In developing the definition the Committee also paid particular attention to clarity: it did not use the verbs ‘trace’ or ‘track’ as it was considered not appropriate to use,
in the definition, terms with the same root as the word to be defined (‘to trace’ was replaced with ‘to follow the movement’). The phrase ‘production, processing and distribution’ was also chosen in order to describe succinctly the range of the operation of traceability/product tracing. The Committee also clarified that the term ‘production’ could be interpreted in such a broad manner as to cover food-producing animals, feed, fertilisers, pesticides, veterinary drugs, and any input of plant or animal origin, for example, if relevant for specific applications of traceability/product tracing to food.

The Codex definition only applies to ‘food’ and not ‘feed’ because the inclusion of feed and food-producing animals in the general definition might pose difficulties, and because in the Codex context traceability/product tracing could cover these parts of the food chain only if, in some situations, there was an impact on the food itself.

The principles

Following instructions of the 27th Session of the Commission, the CCFICS made tremendous efforts during the next few years, and the 14th Session of the Committee (November 2005) finalised the proposed draft principles for traceability/product tracing as a tool within a food inspection and certification system. The principles were adopted by the 29th Session of the Commission (July 2006) and published in the Codex Alimentarius as ‘Principles for traceability/product tracing as a tool within a food inspection and certification system’ (CAC/GL 60–2006) (9, 25, 26).

The Principles aim to assist competent authorities in utilising traceability/product tracing as a tool within their food inspection and certification systems that may be applied, when and where appropriate, in order to contribute to the protection of consumers against food-borne hazards and deceptive marketing practices as well as the facilitation of trade on the basis of accurate product description.

The Principles recognise the dual mandate of the Codex Alimentarius; the document focuses on food safety but recognises that the principles may also apply to non-safety areas (such as the prevention of economic fraud and consumer deception).

Key messages throughout the text with regard to utilising ‘traceability/product tracing’, as a tool within a food inspection and certification system, include:

– as a tool, traceability/product tracing does not itself improve food safety outcomes or promote fair practices in food trade. It must be applied in combination with a measure or requirement

– the implications of implementing traceability/product tracing, especially for developing countries, should be fully considered

– the exporting countries should not have to replicate the traceability/product tracing tool of the importing country. They need only meet the objectives of the importing country’s food inspection and certification system– the rationale for the application of traceability/product tracing, with the objectives of the food inspection and certification system in which it is contained, should be clearly defined

– the use of traceability/product tracing should be justified on a case-by-case basis

– appreciating that the use of traceability/product tracing as a tool would not be the subject of a determination of equivalence. Equivalence is about measures or requirements, not tools as such; in other words, the objectives of the food inspection and certification systems are all that is required to be met by the exporting country.
Traceability/product tracing in Codex texts

In the light of the definition provided earlier, it appears that the concept of traceability/product tracing had already been included in Codex texts developed before the definition was adopted by the Codex Alimentarius Commission, even if the words ‘traceability/product tracing’ were not explicitly used in these texts.

Traceability/product tracing is included in Codex texts either as a measure intended to protect the health of consumers (in other words, a risk-management measure), or to ensure fair practice in the food trade (TBT-related). As an SPS measure, traceability/product tracing helps to identify, trace and effectively and rapidly remove unsafe foods at any stage of the food production and distribution chain, and facilitates the identification of food safety problems.

Codex texts that incorporate elements related to traceability/product tracing as food safety risk-management measures include, among others:

- ‘Code of practice for low-acid and acidified low-acid canned foods’ (CAC/RCP 23–1979), in relation to product processing history (1)
- ‘Principles for the risk analysis of foods derived from modern biotechnology’ (CAC/GL 44–2003), in relation to the tools to facilitate the implementation of risk management measures (16)
- ‘Code of practice on good animal feeding’ (CAC/RCP 54–2004), in relation to withdrawal or recall of products in case of known or probable adverse effects on consumers health (4)
- ‘Code of hygienic practice for meat’ (CAC/RCP 58–2005), in relation to rapid withdrawal and recall of products and to allow investigations (7)
- ‘Principles and guidelines for the conduct of microbiological risk management’ (CAC/GL 63–2007), in relation to rapid withdrawal/recall procedures (15)
- ‘Model certificate for fish and fishery products’ (CAC/GL 48–2004) and ‘Model export certificate for milk and milk products’ (CAC/GL 67–2008), in relation to public health investigations and recalls (6, 14)
- ‘Code of hygienic practice for eggs and egg products’ (CAC/RCP 15–1976), in relation to the effectiveness of food safety control systems (10)
- ‘Recommended international code of practice for the processing and handling of quick frozen foods’ (CAC/RCP 8–1976) and ‘Code of hygienic practice for powdered formulae for infants and young children’ (CAC/RCP 66–2008), in relation to the withdrawal of products (18, 11).

The application of traceability ‘to ensure fair practices in the food trade’ is related to the first of the General Principles set down in the ‘General standard for the labelling of pre-packaged foods’, which reads: ‘Pre-packaged food shall not be described or presented
on any label or in any labelling in a manner that is false, misleading or is likely to create an erroneous impression regarding its character in any respect.’ In order to ensure fair practices in labelling, inspection authorities may need to check the characteristics of the products, not only in the end product, for example as regards composition, but tracing the products to their production or processing conditions to determine whether they correspond to the description on the label. The ability to control the process is particularly important when claims are made about the production process, as in the case of organically produced foods.

The use of traceability ‘to ensure fair practices in the food trade’ could be considered as a tool to help to protect consumers against deception and fraud in the market place and unsubstantiated product claims. The ‘prevention of deceptive practices’ is a legitimate objective described by the WTO TBT Agreement.

Codex texts that incorporate elements related to traceability/product tracing as a measure to ensure fair practice in the food trade include, among others:

- ‘General standard for the labelling of pre-packaged foods’ (CODEX STAN 1–1985), in relation to the country of origin provisions and lot identification (13)

**Cooperation with the OIE and other international intergovernmental organisations**

The Codex Strategic Plan 2008–2013 recognises that the Commission does not operate in isolation and that it must work closely on matters of common interest with other relevant international organisations to achieve complementarity, avoid duplication and prevent the development of contradictory standards. The Codex Strategic Plan states that the Commission should consider the establishment or promotion of cooperation with other relevant international intergovernmental organisations, in particular the OIE and IPPC, to ensure effective collaboration and coordination, in line with the guidelines on cooperation between the Codex Alimentarius Commission and international intergovernmental organisations in the elaboration of standards and related texts, adopted by the Commission in 2005 (17).

Codex recognises the importance of a holistic (‘whole food chain’) approach to food safety and quality, and the need to apply good agricultural and veterinary practices in primary production in order to ensure food safety. In order to avoid duplication of effort and gaps, Codex is striving to achieve closer cooperation with the OIE, whose standards, like those of Codex, are specifically recognised in the SPS Agreement.

Both the OIE and the Codex Alimentarius Commission have acknowledged the usefulness of working together and strengthening their collaboration to reduce gaps and duplication. Members of the OIE and the Commission have expressed their wish for a closer cooperation between the two international bodies while recognising the accomplishments already achieved. Strengthened collaboration has resulted in a better exchange of information between the OIE and the Commission, a reduction of gaps and duplication in their work and the setting of more coherent standards.
## Codex Organisational Chart
(As of March 2009)

### CODEX ALIMENTARIUS COMMISSION

<table>
<thead>
<tr>
<th>General Subject Committees</th>
<th>Commodity Committees</th>
<th>Ad Hoc Intergovernmental Task Forces</th>
<th>Regional Coordinating Committees</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Principles (France)</td>
<td>Milk and Milk Products (New Zealand)</td>
<td>Antimicrobial Resistance (Republic of Korea)</td>
<td></td>
</tr>
<tr>
<td>Food Additives (China)</td>
<td>Processed Fruits and Vegetables (USA)</td>
<td></td>
<td></td>
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<tr>
<td>Contaminants in Foods (Netherlands)</td>
<td>Fish and Fishery Products (Norway)</td>
<td></td>
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<tr>
<td>Food Hygiene (USA)</td>
<td>Fresh Fruit and Vegetables (Mexico)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Import and Export Inspection and Certification Systems (Australia)</td>
<td>Fats and Oils (Malaysia)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Active:**
- Sugars (United Kingdom)
- Meat Hygiene (New Zealand)
- Cereals, Pulses and Legumes (USA)
- Vegetable Proteins (Canada)
- Natural Mineral Waters (Switzerland)
- Cocoa Products and Chocolate (Switzerland)

**Adjourned:**
- Methods of Analysis and Sampling (Hungary)
- Pesticide Residues (China)
- Residues of Veterinary Drugs in Foods (USA)
- Food Labelling (Canada)
The cooperation between the OIE and the Commission has already improved the exchange of information and cross-referencing between the respective international standards. The cross-referencing of OIE and Codex texts on traceability is among the examples of where this has been successfully applied.

**Conclusions**

Codex standards, guidelines and recommendations have the objective of protecting consumers’ health and ensuring fair practices in food trade. Adherence to Codex provides the basis for ensuring food safety and quality and meeting the requirements for international trade. The definition of traceability/product tracing and the Principles for its application provide guidance to governments. In the future, the existing work on traceability/product tracing within the Codex Alimentarius will be reviewed and complemented as necessary.

**References**


Session 3

Overview of available tools and technology

Chair: Dr Peter Fernandez
USDA-APHIS-IS, US Mission to the European Union

Objectives: to review available tools and technologies for specified sectors
Technology for the identification and traceability of cattle and sheep

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Summary
Agri-Traçabilité Québec (ATQ) is responsible for the development and implementation of a system for the permanent identification and traceability of agricultural products from farm to fork, and relies on the use of a variety of leading-edge technologies to carry through its numerous responsibilities.

ATQ uses a diversity of techniques for identifying livestock (RFID chips), as well as for information gathering (reading instruments), the electronic transfer of this information (software and communication networks), and lastly for information storage (multispecies database).

ATQ has also continually striven to research, adapt and develop new technologies for the transport of live animals and their sale by auction.

Quebec’s traceability system is innovative in the way it promotes the use of these new technologies, which facilitate the work of the various stakeholders involved and ensure practical and effective application in the field.

Keywords: Automation tools – Farm to fork – Information transfer – Multispecies database – Permanent identification – Reader – RFID – Traceability.

Introduction
During the 1990s, the agricultural world was shaken by numerous animal health crises: bovine spongiform encephalopathy (BSE), foot and mouth disease, swine fever and avian flu. These caused major economic losses and forced many countries throughout the world to develop and put in place various systems for the identification and traceability of animal herds.

The agri-food industry in Quebec, Canada was also proactive in order to protect its livestock, to reassure consumers about the safety of its products, and to provide the sector with permanent tools for its agri-food products to enable it to stay competitive internationally.

The creation of Agri-Traçabilité Québec
During the Rendez-vous des décideurs de l’agriculture et de l’agroalimentaire québécois in 1998, the Union des producteurs agricoles and the Quebec government officially committed to the shared goal of implementing a permanent identification and traceability system for agricultural products from farm to table. As a result, on 25 September 2001 an independent non-profit organisation, Agri-Traçabilité Québec Inc. (ATQ), was created.

The organisation’s mission is to contribute to the improvement of food safety and the competitive capacity of Quebec’s farm commodities by aiming to develop, implement and operate a permanent identification and traceability system for both livestock and produce.

Among its mandates is the creation and management of a multispecies database which groups together, in a single place, information related to traceability for various agricultural sectors as they are gradually entered into the system. In order to assist the various stakeholders in these
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sectors, the choice was made to use tools originating in the field of information technologies, such as RFID and the cellular phone. These tools will permit the automation of the processes of collection and transmission of information related to traceability. Lastly, another mandate given to ATQ involves the planning and implementation of partnerships for information exchange between different stakeholders in the agri-food sector. These partnerships can take the form of joint data transmission forms between two organisations, or data transmission to ATQ by an organisation that already receives information from producers. The latter is carried out to avoid producers having to send the same information twice.

The Quebec traceability programme has several objectives, including the wish to rapidly limit and eliminate the effects of a crisis by improving the reaction time to animal health or food safety problems. The Ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec (MAPAQ), one of the most important stakeholders in the area of traceability, keeps a continuous watch over diseases that could potentially affect food quality. By ensuring that regulations are followed, MAPAQ promotes the implementation of preventive measures and controls throughout the whole food chain, from the farm all the way to the consumer.

ATQ’s very first mandate from MAPAQ was to put in place a traceability system for the dairy and beef cattle sectors, from birth to the slaughterhouse, and this system has been in place since the spring of 2002.

Specifics of the Quebec traceability system

For livestock traceability in Quebec, the many stakeholders are bound by three very precise requirements. The first is related to the identification of the animal at birth. In the cattle sector, calves must be identified seven days after birth (a maximum of five months is allowed for animals born on pasture).

The second requirement concerns the obligation to activate the animal’s identification tag: that is, to declare that the tag has been attached and that it records the birth date, the animal’s sex and the ATQ farm site number where the animal is located, along in association with the tag identification number.

Lastly, each time an animal is transferred (arrives or leaves a site), it is mandatory to make a declaration of this to ATQ. Transfers may be between buildings, pastures, auctions, agricultural exhibitions, veterinary hospitals, slaughterhouses, and so on.

The tools of traceability

The following are the three pillars of the Quebec traceability system:

Site identification

All production and sorting sites are identified in the database. Each stakeholder receives a unique seven (7) digit identification number for each of their sites, which might be a barn, pasture, auction, specialised veterinary centre, slaughterhouse and so on. Each stakeholder receives a laminated card from ATQ which contains the site number, and the address and description of the site.

Animal identification

In Quebec and throughout Canada, each animal must be uniquely identified (with a 15-digit number in International Organization for Standardization (ISO) format). After consultations
with the industry, pilot projects and studies in the field, ATQ offered several operational
proposals from which mandated representatives from the industry sectors selected the preferred
identification method. This choice was based especially on the quality of manufacture, the
ease of integration into the realities of the sector and the potential for the use of electronic
information transfer methods rather than manual procedures. In the case of cattle production,
a double identification system made up of one electronic tag (RFID) and a visual tag with a
barcode was selected.

Declaration of movements

Subsequently, all animal transfers must be declared and recorded in ATQ's central database,
no matter what type of transfer is made.

Alleviating the workload for stakeholders

Every stakeholder actively contributes to the system: producers, auctions, agricultural
exhibitions, veterinarians, slaughterhouses, and so on. In order to facilitate the transfer
of information and to ensure its validation, tools were implemented to help the numerous
stakeholders in their responsibilities related to traceability. A number of measures were
implemented to support stakeholders in their actions, including a customer service centre
reachable by a toll-free telephone number; the merger of several declaration forms into a
single form; the adaptation of management software for the transmission of information to
ATQ; the creation of free traceability software (FormClic) by ATQ which allows for the transfer
of different traceability declarations in electronic format; and finally, a website for transactions
(ATQ Direct) which accepts traceability declarations online.

Exchange of information

The recent crisis regarding BSE allowed for the opportunity to profit from the data collected
in the ATQ database and to release concrete applications. ATQ worked together with Quebec
slaughterhouses and the Canadian Food Inspection Agency (CFIA) in order to implement an
information exchange mechanism. As a result, agreements were concluded in order to allow
specifically accredited and mandated veterinarians access to the birth dates and origins of
livestock, in order to get official export certificates online — via ATQ Direct — or to verify the
actual age of an animal before its slaughter. Particular attention was dedicated to the question
of security concerning the transmission of these types of information. For this reason, very
strict rules concerning access to and diffusion of information were established.

Automation

With the constant concern about trying to ease the workload of stakeholders in meeting
their obligations concerning traceability, a number of automated collection and data transfer
solutions have been implemented at production sites (i.e. RFID hand-held tag readers,
programs compatible with these readers, RFID status chips, etc.).

As well, the facilities of many stakeholders are equipped with automatic tag readers, including
some farms. In fact, farmers can benefit from using RFID status chips to identify their
animals, which also allow them to profit from new technologies such as RFID tag readers,
pre-programmed chips in tags (with data listing the sex and dates), and various models of
electronic weigh-scales. The use of these scales allows producers to save time and better
manage their herd, to eliminate paperwork and manual transcription errors, and also to make
frequent updates to their traceability file.
The transportation of live animals is an important link in the traceability chain in Quebec, and ATQ is currently working on developing and implementing various methods for collecting and transmitting information adapted to this important part of the sector. A programme especially created by ATQ, TransTraq, installed on a hand-held computer, can be linked via a wireless connection to a reader antenna and a mini printer, allowing for the transfer of all traceability information directly to the ATQ database using cellular networks.

On the same basis, automation of strategic sites is also a major asset of Quebec’s traceability system. Thus, on the level of live animal auctions and sorting centres (stations for assembling livestock), the use of fixed antenna readers allows a quick and precise reading of the identity of each animal as it arrives. This information is then entered into the market management systems at the auctions and sorting centres, which also allows faster grouping and classifying of animals and an invoicing system linked to the animal’s identification and sale weight. All of this information is then sent, within a few hours, to the ATQ database through computerised protocols.

The automation of processes at slaughterhouses also allows traceability activities to continue, through the use of features in the RFID chips, until the animal carcass is butchered. The fact that RFID chips are used also provides an assurance that specified risk materials (SRM) are efficiently managed throughout the entire slaughtering process. The data related to slaughter are also transmitted, within a few hours, to the ATQ database via computerised protocols.

It should also be mentioned that certain Quebec companies have chosen to follow the work begun by the cattle industry by offering complete traceability for their products, from the birth of the animal to the consumer’s plate. Moreover, this way of doing things has allowed them to maintain and/or gain access to privileged export markets.

**Convincing results**

In Quebec, in 2009, the ATQ database contained 24,000 agricultural producers, 27,500 production sites, 7.9 million animals and 33 million events. Updated hourly, the ATQ database reflects the daily amount of work that agricultural producers and stakeholders do in working to preserve the excellent reputation Quebec has earned for the quality of its agricultural products.

The next sectors to join the ATQ database will be pork, poultry, table eggs, goats, horses, the market garden sector and beef meat.

**Conclusion**

With the implementation of its own identification and traceability system, Quebec is providing itself with an efficient and effective administrative tool in order to preserve its excellent reputation for the quality and safety of its agricultural products. The centralisation of information for all types of production in a single location through the creation of a single, multispecies database, along with the collaboration from all the stakeholders in the agri-food industry, will contribute to the development of a reliable traceability system from the farm to the consumer’s table.

Lastly, in the current context of globalisation, the development of compatible traceability systems for all of North America is desirable for the improvement of reaction times in the event of an animal health or food safety problem.

Several findings are clear from our experience. For instance it is important to visualise from the beginning an integrated system where all agricultural products can be found in a single database. Other than the aspect of regulation, a credible traceability system must also rest
on the mandatory participation of all stakeholders and the implementation of partnerships. Lastly, it is evident that making stakeholders aware of their responsibilities is crucial, and that we must be constantly mindful to simplify the tools and processes that are required in order to facilitate the tasks of the various stakeholders involved.

References
This paper is entirely based on the Quebec’s permanent identification and traceability system experience (Agri-Traçabilité Québec), in operation for the past eight years.

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Current tools and technologies for the identification and traceability of small ruminants

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Summary

Animal identification (ID) is a key action for all systems that collect data for monitoring and performance recording of animals, and for tracing them and their products throughout the production and commercialization chains. Sheep and goats have been identified for many years with different tools and with varied results in the diverse and harsh environments in which they are typically produced. Because of anatomical and behaviour differences between sheep and goats, as well as other small ruminant species (including camelids and deer), the use of specific devices for each situation is warranted.

Conventional ID technologies, based on visual devices, have their place as a starting point in the identification of small ruminants in countries that are taking the first steps to implement ID systems. However, these systems have some shortcomings and are not efficient enough for dynamic and on-field reading. More reliable and automated ID reading systems are required in the modern livestock industry.

Many systems based on imaging and radiofrequency technologies are currently available and have been implemented in practical situations. Automated bar code reading and tattoo artificial vision were inefficient and were discarded for live animals and carcass ID. Retinal imaging is now used as a reliable system for auditing sheep ID but there is little information on its use in other species. Moreover, its utility for harvested or dead animals has been questioned. Radiofrequency (low-frequency) by passive (no batteries) ISO standardised transponders was used early on for the electronic ID (e-ID) of sheep and goats, and this is the most common technology in current automated monitoring and performance recording equipment in livestock.

Use of e-ID allows the automatic reading of an animal’s ID without visual contact (or external devices) and, combined with sensors and positioning equipment, provides a reliable method for monitoring, performance recording, and traceability of animals and most of the animal products under field conditions. The e-ID (ear tag, bolus and injectable), is fully recognised for official sheep and goat ID in the European Union, and provides a good basis for compliance with the international standards of the World Organisation for Animal Health (OIE). The e-ID system has been mandatory in Spain since 2006. A double system based on the joint use of e-ID and DNA markers has been tested recently for the traceability of lambs and meat. Finally, studies on e-ID implementation in the sheep and goat industry concluded that it is a cost-effective technology and recommended its use in practice. New developments in tools for livestock management (e.g. milk recording and oestrus detection) will underline the benefits of using e-ID in small ruminants in the near future.

Keywords: Electronic identification – Identification systems – Retinal imaging – Sheep and goats – Traceability.
Overview of tools and technology: pigs

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ICAR Subcommittee for Animal Identification

Summary

This presentation reviews available relevant technologies for the identification of pigs. The presentation discusses the applicability of low-technology and high-technology solutions, with reference to the associated strength, weaknesses, opportunities and threats.

Both low and high-technology solutions, which may be used to identify individual animals or groups, can be used to good effect, depending on the objectives and scope of the traceability system. The World Organisation for Animal Health (OIE) standards for animal identification provide scope and flexibility, and countries are encouraged to implement solutions that are appropriate to their legal systems, government objectives and economic conditions.

Ear notching is a simple, low-cost method that can be used for on-farm identification of pigs. However, this method is limited in terms of the detail that can be provided and for traceability it is important to maintain animals in groups and record relevant information on each group.

Systems based on skin tattoos using codes with four to six positions in the code and numeric or alphanumeric figures enable more detailed information to be provided. For example, this method can provide individual codes for millions of holdings. Tattoo systems are commonly used to provide information on the holding of origin of the animal. While this system alone is not effective for the identification of individual pigs nationwide, a combination of tattoo and ear notching can be used to enable the individual identification of pigs.

Visual ear tags represent a further level of sophistication and can provide more information, ranging from the identity of the holding of origin all the way to unique individual identification of pigs at national level. It is important that ear tags are durable, tamperproof, can be read with a high degree of accuracy and have a low loss rate. Thus design, performance and cost of ear tags are important considerations.

At the present time, electronic identification methods present the highest level of sophistication and cost. Both electronic ear tags and injected transponders are commercially available. Electronic identification in theory enables full individual traceability because relevant information on all animals can be automatically read and recorded, whether pigs are moved singly or in groups. For electronic ear tags, the key considerations are the same as for visual ear tags. Injected transponders present additional considerations in that skilled personnel and specialised equipment are needed, with attendant costs. A major concern with injected transponders is to ensure the removal of all transponders from all carcasses.

For any type of identification system, recognised technical standards should be used where possible to support harmonisation of national approaches. Internationally recognised performance and conformance tests should be used when choosing identification devices. The International Standards Organization (ISO) has developed relevant technical standards and the International Committee for Animal Recording (ICAR) is the Registration Authority for ISO 11784 and 11785, which deal with the performance of devices.
The pig identification systems that can be used to meet the OIE standards will be presented for discussion at this conference.

**Keywords:** ICAR – Pig identification – Traceability – World Organisation for Animal Health (OIE) standards.

**Identification of pigs**

This paper will look at identification tools and techniques in pigs and how they can be used in establishing traceability. By traceability in pigs is meant complete traceability from birth until after slaughter. This means that the tools used for identification of pigs must remain intact throughout the slaughtering process (stunning, killing, scalding, and the scraping and flaming processes used to strip hair from the carcass). This will be a challenge to some identification systems.

**Visual identification techniques**

**Ear notching**

Ear notching is a convenient way to handle numbering systems for codes that require only a few digits. Ear notches should be applied to piglets with special pliers after cleaning the ear and the pliers.

There are a number of coding systems, and in order to read the notches correctly it is necessary to know which system was used.

One simple system has notches for 1, 3 and 5 in the right ear of the pig, and notches for 10, 30 and 50 in the left ear. This system provides one code only, which is the sum of notches from both ears. This will allow for numbers up to 99 with no more than three notches in each ear. The system may be extended by punching one hole in the left ear as the code for 100 and one hole in the right ear for 200. In this way the number range can reach 399.

Another simple system has notches for 1, 2, 3 and 5 in the left ear and 10, 20, 30 and 50 in the right ear, allowing for 119 numbers. This system could be extended as above by holes in the ears. In this case, the single digits and the tens are in opposite ears from those the previous system. The extra notch in the left ear has a value of 5 but in the other system it would be interpreted as just another notch with value 1. This demonstrates the need to know exactly which system was used and for regional standardisation.

A more developed code system is used in North America. It has notches for 1, 3, 9, 27 and 81, allowing for a code range up to 161 in just one ear. The system provides two codes, one from each ear. Normally the full code range is used only in the right ear, to indicate a litter number. In the left ear notches for 1, 3 and 9 are used to indicate an individual pig number within the litter. This system can identify all the individual pigs from 161 litters.

Trained people can easily decode the information, but some combinations require a large number of notches.

Ear notching is easily done and the marks should be made in the first few days of the animal’s life. It offers a relatively safe lifelong identification because it will be easily seen if any further notches are made at a later stage. However, if the animal’s ears are torn this may jeopardise the identification.

The code range of ear notch systems is not sufficient for codes to identify the premises from which pigs originate. However, in combination with some other kind of identification of the place of birth and movement records, such systems may allow for traceability to a quite high extent.
Tattooing

Using tattoos extends the code range dramatically. A six-symbol tattoo with numerical symbols can provide 1 million minus 1 ID numbers. If an alphabetical symbol is substituted for one numerical symbol in a specific position the code range will almost double (depending on how many letters are excluded because they could be confused with figures: for example Z could be confused with 2). A six-symbol code with 4 numerical symbols and 2 alphabetical symbols in fixed positions will provide about 4 million unique codes. As with ear notches, tattoos provide a relatively safe means of identification because it is difficult to change the original tattoo in a way that would not be obvious.

Ear tattoos

Tattoos can be made in pig’s ears by using pliers with exchangeable symbol blocks. The technique has to be carried out with painstaking accuracy to ensure the tattoo can be read clearly later. The site where the tattoo is to be placed must be clean and so should the needles of the tattoo device, which must be covered with the tattoo ink. The needles should completely pierce the animal’s ear and after the pliers are released the tattoo ink should be thoroughly rubbed into the puncture marks. Failure to fully comply with these guidelines will often cause problems with readability later on.

Tattoos can be applied to very young pigs, but if long codes are used it will be difficult to find sufficient space for them without touching veins or ribs in the ear. Moreover, the size of the tattoo will change as the ear grows, and as the different parts of the ear do not grow at the same rate this could make the tattoo less readable. Tattoos are quite easily visible on light-coloured animals with little hair. However, the ink may fade, and on dark-coloured and/or hairy animals tattoos may be difficult to find and read even if brightly coloured ink is used.

Schembri et al. compared the readability of ear tattoos with that of ear tags in cross-breed pigs of light skin colour (11). The visual readability of ear tags was found to range from 88% to 94%, while the readability of ear tattoos (even when they had been applied with care) was unexpectedly low, with levels of 26% to 56% eight weeks after the tattooing and of 22% to 40% just before slaughter. This was due to fading of the tattoo ink. Gosálvez et al. tested tattooing against ear tags and injected transponders on Iberian pigs, which are dark skinned (3). They found that all tattoos were difficult to read during the growth/fattening period because of the dark colour of the pigs’ coats and the dirt covering them. They also found that tattoos could often not be read at slaughter because the figures were unclear.

Body tattoos

Tattoos placed on the body of the pig can be made by slap marks. Examples of positions are on the left shoulder or on the gammon (ham). Slap marks are often used on animals to identify the farm of origin or the farm from which animals were sent to other farms or to slaughter. As mentioned earlier, use of a six-symbol alphanumerical tattoo allows for millions of possible codes. For this reason tattooing is often used for identification of premises, which can easily be applied by a tattoo slapper.

M. Hernández-Jover et al. evaluated tattooing of pigs as a tool for traceability in New South Wales, Australia (6). Pigs had to be identified by a tattoo slap on the shoulder with brands of six 20 mm high numerical digits in two rows. Among branded pigs at two sale yards, only between 77% and 85% of brands were readable; the most common reasons for loss of readability were faint ink or missing digits. In these sale yards, a clear difference was found
between readabilities of tattoos from different producers. In two abattoirs, readabilities were between 72% and 80% but in the abattoirs there was no difference between producers. It was concluded that faulty tattoo equipment and application were probably the main factors influencing the readability of tattoos.

Tattooing can provide a very effective way to identify the premises that pigs originate from. In combination with movement records at herd level this offers a certain level of traceability. Indeed, in the EU herd identification of pigs and movement records provided sufficient traceability to control swine fever.

A combination of a premises code, shown by tattoos, and individual identification at farm level by ear notch or by ear tattoo allows the identification of all animals nationwide, provided that ear notch systems and tattoo systems are standardised. With movement records at animal level it is possible to have full individual traceability. However, if the tattoos are not easily readable, identification and traceability may be jeopardised.

**Ear tags**

To achieve a high degree of traceability when using ear tags it is important to choose high-quality tags with good locking mechanisms. (If the animal has only one ear tag and no other kind of identification, losing the ear tag means losing all identification.) Tags must be easily readable, which means for example that they must have good-quality printing and be of a proper size.

Ear tag losses are generally found to be low during the lifetime of pigs for slaughter. In on-farm trials Babot et al. found loss rates for ear tags of less than 2.7% (1). The final on-farm readability was 99% for visual plastic ear tags and about 96% for electronic ear tags. Santamarina et al. found that the loss rate in the slaughtering line was about 3.5% for visual tags and for one type of electronic tag (10). For another electronic tag, however, the loss rate was 11.5%. Marchi, Ferri and Comellini found that the loss rate increased considerably during the last three months of the pigs' fattening cycle, coinciding with movements and regrouping of the pigs (9). The loss rate is also affected by the physical environment (fencing type). In different tests the loss rate on farms varies from less than 2% to about 30%.

Ear tags are easily applied, but this has to be done carefully to ensure that the locking mechanism is correctly closed. Ear tags with visual numbers may provide various levels of identification, from the premises number to a full international individual lifetime identification. Because of the possible loss of ear tags the animals should wear two identical tags, one in each ear, or a combination of ear tag and some other type of identification.

In combination with movement records, ear tags with low loss rates can provide traceability to a level defined by the information on the ear tag. However tests have shown that more than 7% of tags are lost between the time they are attached and the end of the slaughtering process, and this will jeopardise individual traceability.

Ear tags available on the market vary widely in quality. For traceability systems it is extremely important to avoid tags that have high loss rates or with printing that fades or can get smudged. International test protocols for plastic ear tags have been defined by the International Committee on Animal Recording (ICAR). Tests which can lead to ICAR approval consist of a laboratory test and a field test. In the laboratory phase, ear tags are tested for the breaking force of their locking mechanisms, for their durability when exposed to acids, alkalis and UV-light, for their response to climatic influence through an artificial aging process, and for visual readability. Field tests are at present only made on
tags for cattle, but loss rates and possible effects on animals are expected to be similar for pigs and other species.

**Electronic identification techniques**

Electronic identification of pigs may be relevant for breeding animals and official identification schemes, or where handling such as weighing, sorting and feeding of pigs on farm can be automated. The devices include ear tags with transponders, and subcutaneously or intraperitonally injected transponders.

**Ear tags with transponders**

Basically, ear tags with transponders look like other plastic ear tags that provide visual identification. Often the electronic ear tags are of the button type. The transponder is typically integrated into the female part of the tag, which is somewhat bigger and less flexible than in a non-electronic tag. This may lead to higher loss rates for electronic than for non-electronic tags, but electronic ear tags have the advantage that they can also display visual identification. It is recommended that they should be used in combination with other identification systems, so that if the electronic tag is lost the pig can still be identified.

Using high-quality ear tags in farms with a suitable physical environment the loss rates of electronic ear tags can be held under 4% during the lifetime of the pig before it goes to slaughter, and a similar loss rate occurs during the slaughter process. However, tests show that some tags had dramatically higher loss rates during slaughter, which will jeopardise individual traceability.

**Injected transponders**

Injected transponders share some common problems that need to be addressed.

First, injected transponders do not give a means of visual identification, which is useful in the everyday handling of animals. Thus one of the previously described methods of visual identification may also have to be used. Animals with injected electronic identification should also be marked visually to show that they have been injected.

Trained people and special equipment are needed to insert transponders correctly. The readability of the transponder must be tested before application and it should also be read just after insertion to check that it is still active.

All injected transponders must be removed from the animal at slaughter or rendering, so that the transponder or parts of it will not be found in the products. Almost every part of the pig will be used for human or animal consumption, and for that reason no metal, glass or plastic can be allowed to stay in any part of the animal after slaughter or rendering. Active transponders can of course be found even if they migrate from their original position, though this does take some time. Finding transponders which for some reason are no longer active could however be a much more difficult problem. Thus, for security reasons, pigs with injected transponders must be marked so that slaughter houses and rendering plants will be aware that they have to remove a transponder from the animal.

**Injection sites**

Transponders can be injected subcutaneously directly under the skin of the pig. The injection sites include the base of the ear, the outer ear, between the armpit and the body and a
few other places. Depending on the injection site, different sizes of transponders can be used.

Klindworth et al. tested different injection sites and found that transponders implanted in the ear region of piglets have to be of limited size, and this restricts the expected read distance (7). The loss rate of transponders in the outer ear was about 50%. The loss rates of transponders injected in the ear base are at levels of 2% to 6%, increasing with transponder size.

Hernandez-Jover et al. (4) compared transponders implanted in the ear base, between the armpit and the body, and at the shinbone. Best readability was obtained in the ear base, at 93.6% followed by transponders between the armpit and the body at 79.2%. Migration of injected transponders was low, with an average movement of 24 mm in those between the armpit and the body. Hernandez-Jover concludes that none of the tested sites for subcutaneous injection of transponders can be recommended for electronic identification of pigs.

Transponders can be injected intraperitonially: that is, into the abdominal cavity of the pig. The injection site in a piglet is on the left ventral side of the animal, approximately 1 cm from the ventral line and 2 cm behind the navel.

Hernandez-Jover et al. (5) compared plastic ear tags, transponders injected into the base of the ear and intraperitonially injected transponders. The traceability of animals after slaughter was 87% with conventional ear tags, 68% with electronic ear tags, 73% with ear-base transponders and 99% with intraperitonially injected transponders.

Caja et al. (2) and Gosálvez et al. (3) showed that in comparison with ear tags and subcutaneously injected transponders, only the intraperitonially injected transponders secure more than 98% readability after slaughter. Intraperitonially injected transponders have no negative effects on animal health and growth, and no negative reactions have been observed. Removal of intraperitonially injected transponders after slaughter is faster than removal of subcutaneously injected transponders. Most are found attached to the viscera or loose in the abdominal captivity.

Ear tag transponders could be used, but their high loss rates mean that they do not ensure proper traceability. Subcutaneously injected transponders also have unacceptably high loss rates. In contrast, intraperitonially injected transponders provide very high traceability even after the slaughtering process. They can be read electronically, which is faster than a visual reading and removes the chance of human error in reading the tag or writing up the details. They thus provide a suitable basis for automatic recording and reporting to the traceability database or automated management.

Transponder technology

The international standards for transponders to be used in animal identification are ISO 11784 and ISO 11785. These standards are for low-frequency transponders (the frequency is 134.2 kHz).

Low-frequency signals are able to penetrate water and body tissue, which is far more difficult with higher-frequency devices (8). Low-frequency transponders can be read even if they are inside the animal (intraperitonal transponders in pigs or boluses in ruminants) or on the far side of the animal from the reader. Reading distances are relatively short, so the animal identified has to be close to the reader. Automated milking systems, feeding stations, weighing devices or sorting gates are well suited to this kind of reading because it is important to know exactly which animal is being handled.
ICAR is the appointed Registration Authority of the International Organization for Standardization (ISO) for identification devices conforming to ISO 11784 and ISO 11785. It tests and approves transponders on behalf of ISO. All approved transponders can be found on the ICAR website, where ICAR will also now publish results from performance tests. The website thus provides decision makers worldwide with the information they need, based on independent and comparable tests.

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Traceability of poultry eggs and poultry meat: tools, and the relationship with a national certification scheme

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Summary

Traceability in the poultry meat and egg sector has existed in many countries for over half a century. Originally established with the aim of quality assurance for the consumer, and producer management, traceability systems are a compulsory step for food safety and the prevention of zoonotic diseases.

In poultry production, traceability covers the entire production chain from the hatchery through the farm, slaughterhouse, packaging and processing to the point of sale of the finished product.

A wide variety of tools exist to achieve the objectives of traceability. The choice of tools depends on the size of the unit involved (family, rural or industrial) and the type of production system, intensive or outdoor.

The methods used can be either more or less sophisticated, and include paper records or labels, bar codes, and more innovative tools such as electronic databases, radio frequency identification (RFID) chips or electronic data interchange (EDI). Within the poultry industry the traceable unit is the flock whereas at the packaging plant traceability of the saleable unit is feasible.

For an effective use of traceability, it is important to harmonise national systems with international standards established by the World Organisation for Animal Health (OIE) and the Codex Alimentarius Commission. In France, following the introduction of European regulations (178-2002), guidelines were drawn up to help farmers implement these compulsory measures. This approach seems to be a good way to implement traceability in the production chain. Moreover, the existence of a national certification scheme is an advantage for the establishment of traceability systems that use an independent third-party organisation to provide control.

Keywords: Biosecurity – Codex standards – Poultry – Traceability – World Organisation for Animal Health (OIE) standards.
Overview of available tools and technology:
the GS1 Traceability Standard (GTS) system (food processor/retailer)

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Summary

From the perspective of information management, implementing a traceability system within a supply chain requires all parties involved to systematically associate the physical flow of materials, intermediate and finished products with the flow of information about them. This requires a holistic view of the supply chain, which is best attained by deploying a common business language – the GS1 system. Its global reach and universal acceptance by consumers, businesses and governments make it uniquely positioned to provide the appropriate response to traceability system requirements.

The GS1 Global Traceability Standard (GTS) system is a process standard that defines the business processes and the minimum data management requirements for traceability systems. This definition is independent of the technology to be utilised. It enables companies to implement tracking and tracing of products as they move between companies, whatever the language and tools chosen by each stakeholder. It is based on the use of GS1 ‘standards’ for identification of products and locations, including the use of bar codes, radio frequency identification (RFID) and data communication. Food processors and retailers around the globe are using the GTS, benefiting from very cost-effective implementation of reliable traceability systems.

The GTS is being applied successfully in several sectors, including fresh produce, healthcare and meat, and in different geographical regions. Reference case materials can be found at: http://www.gs1.org/productssolutions/traceability/activities/

The GS1 system can be used, within the framework of objectives, scope and desired outcomes defined by countries, as a valuable tool for implementing systems for identification and traceability that are consistent with the OIE/Codex standards.

Keywords: Barcode – electronic product code (EPC) – GS1 Standard – Radio frequency identification (RFID) – Traceability.
Session 4

Public sector perspectives and experiences

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Objectives: to present perspectives and experiences on identification and traceability from various geographic regions, sectors and levels of technological development
Prospects and experiences of Canada's public sector regarding livestock traceability

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Summary

The Veterinary Authority is responsible for protecting animal health and for mitigating public health risks in the event of a zoonotic outbreak or food contamination. To ensure that traceability systems meet this objective, the Canadian Food Inspection Agency, in collaboration with Agriculture and Agri-Food Canada and Canada's provincial and territorial governments and in consultation with industry, has drawn up a strategy for the design and implementation of traceability systems to meet OIE standards. The key elements of Canada's strategy include: the identification of sectors that should develop a traceability system; the identification of information elements that facilitate trace-back; the development of a legislative framework for the exchange of information; the development of performance targets and standards for information management and protection and the regulatory implementation and verification of systems. This presentation will discuss the development of this strategy and the public and private benefits to be derived from traceability systems.


Background

Livestock identification in Canada began with the arrival of the first European colonists and was initially designed to determine ownership of animals put out to pasture. In the 1990s, outbreaks of animal diseases, such as brucellosis in Canada and classical swine fever and foot and mouth disease in other countries, highlighted the livestock sector's vulnerability to animal health emergencies. Canadian cattle and pig producers are especially vulnerable because they rely heavily on exporting their products.

In the late 1990s, Canadian livestock producers set up two non-profit organisations to draw up traceability policies: the Canadian Cattle Identification Agency and Agri-Traçabilité Québec. These organisations are also responsible for collecting and managing traceability data from livestock producers, which were initially declared on a voluntary basis and later under a statutory requirement from the federal government and the government of Quebec for the identification of cattle (2001) and sheep (2004).

The decision of the Canadian Food Inspection Agency (CFIA) to regulate the identification of cattle and sheep was taken jointly with the national organisations representing livestock producers in line with its objectives: to protect animal health and, in the event of a zoonotic disease outbreak or food contamination, to mitigate the public health risk.

National approach

In 2006, the ministers of agriculture and food of Canada's federal, provincial and territorial governments agreed to build on the groundwork prepared by the livestock sector and to develop a nation-wide traceability system in the agriculture and food sectors. The agreement
emphasised the need to improve the existing traceability systems for regulated animals (cattle and sheep) and non-regulated ones (pigs and poultry), and to set up new systems for sectors other than terrestrial farmed animals (e.g. fruit and vegetables, fish and meat). Pig identification and monitoring is expected to be the next target for the amendment of federal regulations. Other sectors not currently prioritised by the governments (those managing goats, deer and horses) have expressed their interest in developing a regulated traceability system to meet animal health and market access requirements.

An advisory committee comprising representatives of the CFIA, agriculture and Agri-Food Canada and Canada’s provincial and territorial governments was set up to develop recommendations for the planned national traceability system. In 2007, the recommendations were discussed with representatives of national livestock organisations in the Industry–Government Advisory Committee on Traceability (IGAC). One of the recommendations that was acted upon was to draw up national standards and performance targets for traceability systems in order to meet two main objectives:

a) to enable the public sector to manage any emergency caused by an animal disease outbreak, food contamination or a natural disaster more effectively, and

b) to improve the competitiveness of the agricultural sector by meeting the requirements of both the domestic and international markets.

These standards and performance targets are based largely on those of the International Organisation for Standardisation (ISO), Global Standards 1 (GS1) and the World Organisation for Animal Health (OIE).

**Legislative and regulatory framework**

In line with OIE policies, Canada recognises three components of traceability: the identification of animals and agricultural products; the monitoring of animal and product movements; and the identification, location and characterisation of establishments through which such animals and products pass. Canada’s Health of Animals Act authorises the CFIA to regulate the first two components for the livestock sector (2). The governments of Quebec and Alberta also have this authority and have exercised it. Canada’s provincial and territorial governments retain the legal authority to regulate the third component. In a context where the two levels of government are able to regulate traceability, it is crucial to develop national standards to ensure interoperability between national and provincial systems and databases.

To meet the objective of the agriculture and food ministers to develop a national traceability system, Canada will need to develop a more appropriate national legislative framework. While the existing federal legislative framework is appropriate for the identification and monitoring of livestock movements, such authority could be challenged in the food sector.

Canada’s cattle and sheep traceability system is currently based on the unique and individual identification of all animals by applying ear tags before they leave their place of birth. Ear tags must be approved by the Federal Minister of Agriculture based on criteria such as legibility, retention and tamper-resistance. The manufacture, sale, loss, replacement and final removal (at slaughter or death) of approved ear tags, as well as the importation and exportation of cattle and sheep, must be declared in the database of the Canadian Cattle Identification Agency or Agri-Traçabilité Québec within a timeframe determined by federal regulations (varying between seven and 30 days depending on the type of event). Grow Forward, Canada’s new agricultural policy framework for 2009 to 2014, should provide for
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the development of infrastructure to collect and transmit information on the movement of identified animals anywhere in the country.

Canada’s Veterinary Authority, the CFIA, is responsible for enforcing all the regulations that it administers, such as the Health of Animals Regulations (3), which describes the requirements for the identification of cattle and sheep and the declaration of their movements. Compliance with regulations is verified in the field (e.g. checks to ensure that all the animals received for public auction are identified) and by consulting the information compiled in the databases (e.g. checks to ensure that slaughterhouses declare the slaughter of identified animals). The compliance data are compiled by the CFIA regional offices. In the event of non-compliance, inspectors may issue a warning and, in certain cases, impose a fine of an amount determined in the Agriculture and Agri-Food Administrative Monetary Penalties Act (1).

In Canada, while the number of regulations for safeguarding public and animal health has increased significantly in recent years, the resources allocated to enforcing these regulations have remained practically the same. The result is a heavier workload for the inspectors responsible for enforcing the regulations. To ensure that this does not undermine the integrity of traceability systems, the animal health risks specific to each type of establishment are taken into consideration when evaluating compliance, especially when deciding the frequency of inspection visits. Automating information collection and transmission will facilitate the enforcement of regulations.

As stated earlier, information on the identification and movement of cattle and sheep that must be declared in compliance with the Health of Animals Regulations is compiled in the databases of the Canadian Cattle Identification Agency or Agri-Traçabilité Québec. In order to fulfill its role of enforcing regulations and evaluating the veracity of the information compiled and of managing animal health emergencies, the CFIA has signed a memorandum of understanding with the Canadian Cattle Identification Agency giving the CFIA access to the information compiled by the latter. The CFIA and Agri-Traçabilité Québec are expected to sign a similar memorandum of understanding in the near future.

The memorandum of understanding with the Canadian Cattle Identification Agency also provides for the appropriate management of information. Indeed, such information is subject to the Privacy Act (4).

Information about the identification and movement of livestock and the location of establishments through which they pass is also declared under statutory requirements or programmes not related to traceability (e.g. the disease control programme). The databases that compile this information have been set up for a variety of reasons and by different parties. The CFIA, jointly with the managers of these databases, is currently developing a strategy of interoperability between the databases themselves, as well as between the databases and information management systems (e.g. the geographical information system) developed mainly by the governments. A national dictionary of traceability data, information exchange protocols and a national portal will be developed as part of this initiative. Emergency simulation exercises, such as the one conducted in 2005 between the Canadian authorities and the United States, will also confirm the interoperability of these systems.

Collaboration between the private and public sectors is needed for developing and operating traceability systems to improve emergency management and meet the requirements of consumers in the wealthiest countries. To guarantee the reliability and credibility of the new traceability systems, systems must be set in place for verifying compliance with regulations, the veracity of information, data privacy and interoperability among databases and systems.
The establishment of international guidelines should make it possible to harmonise and standardise these traceability systems, as well as their implementation and use.

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Identification and traceability in Argentina: a public health and assurance tool

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Summary

Producer registration and livestock identification in Argentina date back as far as the early nineteenth century, for both large and small livestock. Argentina has been conducting extensive movement controls in slaughterhouses and processing establishments since the 1980s. In 2008, this involved more than 37 million cattle, 3 million sheep, 4 million pigs, 1 million equids and 1 billion poultry.

Initially, identification was on a group basis, with fire-branding linking each animal with its owner, except for animals on the pedigree register, which were tattooed individually. From 2003, there has been much progress towards the individual identification of cattle slaughtered for meat export, to enhance quality assurance in the health and safety of products offered to consumers. Since 2006, individual identification has gradually been made compulsory for Argentina’s national cattle herd, with all animals being ear-tagged at weaning.

Since 2001, export cattle establishments have been registered for compliance with the specific requirements of export markets, and arrangements have been introduced to provide for the individual traceability of animals to the slaughterhouse. In 2006 sheep-exporting producers were added, but in this case animals were identified on a group basis. Since 2009, individual identification and management has been made compulsory for equids slaughtered for meat export. Currently there are 265,000 cattle establishments (56 million head of cattle) in Argentina.

Since the introduction of cattle traceability, significant progress has been made, starting with identification on a group basis and progressing to the individual identification (not using electronic methods) of cattle, and the management and control of stock and animal movements.

The animals sent for slaughter are killed and processed in one of 298 meat-processing plants, and 641 processing plants and stores, subject to official inspection by the Servicio Nacional de Sanidad y Calidad Agroalimentaria (SENASA). For meat, management is on a batch basis, applying the highest sanitary and hygiene standards to obtain products that provide for retrospective control and the withdrawal of products from the market in case of need.

To consolidate these actions and ultimately provide a better service to the community, SENASA continues to strengthen its computerisation and communication processes, working on the continuous improvement of information systems in order to exert greater control through an auditable system. This allows the Veterinary Authorities to track the movement of food products at all stages, and provides the product quality assurance that consumers demand. Argentina’s identification and traceability systems conform with OIE and Codex Alimentarius standards, as well as bilateral and national requirements.

Keywords: Guarantee – Management control – Product quality – World Organisation for Animal Health (OIE) standards.
Animal identification and traceability: public sector perspective and experience from Botswana

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Summary
The Botswana Livestock Identification and Traceability System (LITS) is Botswana’s national system for cattle identification and traceability to facilitate market access, food safety and disease control. The system was introduced almost ten years ago following changes in various European Union directives making it compulsory to identify beef from farm to fork as Botswana, a beef exporter to the EU was forced to align its regulations to the requirements of the EU Directives. Before the introduction of LITS, a group cattle identification system based on branding was used. The LITS was implemented by the Department of Veterinary Services and is fully funded by the Government of Botswana but a cost recovery instrument exists through an abattoir slaughter levy. A legal framework has been established and LITS activities are well coordinated among relevant public and private sectors as recommended in the OIE standards.

The LITS identifies all cattle in the country with a unique individual identification number (in a microchip) from three months of age.

The main components of LITS are the Field Data Acquisition System (FDAS), the LITS computerised database, the reticular bolus permanently inserted in the stomach with the Rapid Frequency Identification Device (RFID) or microchip. Any updating done on the system is automatically transmitted to the central database. LITS is a robust system with a wide provision for additional features as the need arises. The individual animal identification number is linked to the owner (name, ID, brand), the area where the animal is reared, the date of the event and the event that is done.

Although LITS was successfully introduced and implemented in Botswana, some implementation problems continue to be experienced such as delays in acquiring equipment and other supplies which are manufactured out of Botswana and poor service delivery by contracted IT companies in the country. The extensive nature of Botswana’s farming system also poses another challenge to the implementation of LITS.

In conclusion, LITS has provided an means for the Botswana cattle industry to access international markets and the system has been subjected to rigorous inspection by various trading partners and results have been positive. The system is continuously assessed for its long-term sustainability in terms of its cost-effectiveness and applicability as compared with alternative systems such as ear tagging.

Keywords: Animal identification – Cattle brand – Crush pan – Farm to fork – Reticular bolus – Traceability.

Introduction
Botswana is a landlocked country with a human population of about 2 million people and a cattle population of 3 million, most of which are found in communal grazing areas with extensive management systems. Because of the ecological situation in the country, which has an arid climate, cattle are a very important resource that has long been recognised, and many
people in Botswana own a few cattle as an income-generating activity. In fact data from the livestock identification and traceback system (LITS) shows that 80% of the national herd is owned by people who own between 1 and 20 cattle in extensively managed areas.

Because the country has only a small human population, the market for Botswana beef has traditionally been the European Union (EU) and the Republic of South Africa. The EU countries account for 70% to 75% of beef exports from Botswana, while South Africa and Norway account for 15% and 10% respectively. Botswana exports 90% of all the beef produced in the country.

As beef in Botswana is export-dependent, it is affected by changes in global consumer demands for healthy and safe meat products, especially in the EU markets. In 1997, the European Union introduced Council Directive EC820/97, which was to become mandatory and to be implemented in 2000, requiring the establishment of a computerised system for the identification, registration and traceback of cattle as well as the labelling and tracing of beef from farm to fork. To meet these new requirements, Botswana initiated a computerised livestock identification and traceback system, moving away from the manual branding system that had been in operation for many years but did not meet the new EU regulations. Over the years additional changes were made by the European Union to the Directive with the objective of strengthening consumer protection, and Botswana had no option but to comply with the stringent new requirements.

**Introduction of the livestock identification and traceback system in Botswana**

Botswana needed to address the limitations inherent in its established animal identification and traceback system in view of the increasingly stringent requirements in the EU markets for a computerised database for cattle identification and beef traceability. In 1999 the country initiated a comprehensive livestock identification and traceback system that would not only address the need for traceback capabilities but also consolidate existing cattle databases relating to brands and cattle diseases management in a seamless IT environment. The system was designed to achieve individual identification, registration and traceback of cattle and beef that would fulfil EU requirements under Directive EC820/97. Before the introduction of LITS, Botswana traditionally depended on branding for cattle identification and traceability. With increasing consumer demand for stringent product quality assurance and traceability, the branding system practised in Botswana was found inadequate and it needed to be strengthened by the introduction of an integrated and computerised information management system.

After feasibility studies and extensive stakeholder consultations which confirmed Botswana’s readiness to implement LITS, the project was introduced in 2001 in a series of stages. A company that was well resourced and familiar with projects of that magnitude was engaged to advise the government during the initial phases of LITS.

In order to implement LITS a legal instrument was introduced under the Diseases of Animals Act and the Cattle Branding Act under Livestock Identification and Traceability Regulations to give the Department of Veterinary Services the authority to enforce the requirements of the scheme.

**Objectives of the livestock identification and trace-back system**

- to establish a computerised system for cattle identification and traceback to ensure market access for Botswana’s beef
- to bring together separate cattle, animal disease and manual brand databases in a single computerised system that can be used to achieve cattle identification and beef traceability in fulfilment of EU requirements and for rapid disease traceback and traceforward
- to bring about efficiency in the livestock and disease information management system.

**Coordination of the system**

The livestock identification and traceback system is implemented under the Department of Veterinary Services in close collaboration with the Government Computer Bureau, with technical backing from the private sector through various contracts for database management and software development. To manage this computer-based programme it was found necessary to work with the private sector so as to enhance departmental capacities; however, the government maintains a core team of experts with sufficient knowledge to supervise the contractors and run the system when new contracts are being processed. This is critical as sometimes contractors underperform or disputes arise, but the system still has to be maintained in order to facilitate the operations of the industry.

Before the introduction of LITS, there was an in-depth investigation of the need for a traceability system, the scope or coverage of the system, the availability of the necessary infrastructure to support the system, the available technologies and stakeholder needs and involvement, as well as the funding mechanism for implementing the traceability system. This was followed by consultation and appraisal which revealed serious weaknesses in the manual branding system and its inability to achieve traceability. Botswana therefore resolved to introduce a digital individual animal identification system using an implanted microchip reticular bolus with a unique number. The system was to be countrywide, but initially limited to cattle only.

Within the department, a small coordination unit supervised by a senior manager was established at headquarters to run the system with support from a countrywide network of extension officers.

**Features of the system**

The three components of LITS are the computerised central database, the field data acquisition system (FDAS) and the animal identification device (bolus). The computerised central database is the point where all the data on animal identification, brand registration, movement records, establishment registration, owner registration, live cattle import registration, cattle census figures and animal disease events are processed and stored. The database is housed in the Ministry of Agriculture, with duplicate copies at the Computer Bureau for risk management purposes. Filters and codes are in place to limit unauthorised access to the data, allowing different officers to make only the entries and alterations that they are permitted in accordance with their grades and authority areas. The database tracks changes and maintains records of those who make them.

The central database is linked to various other crucial databases such as the national identification system housed in the Ministry of Home Affairs and the Botswana Meat Commission, which keeps slaughter records.

Data from the field extension officers on bolus insertions and other procedures undertaken in the field is automatically relayed through a fibre optic linkage to limit human error. Bolus numbers are also read through hand-held readers or mounted static readers and the data is automatically transmitted by radio to the extension officer's field computer and ultimately downloaded to the central database for processing.
The field extension officer’s data acquisition system is composed of the field computer, which is popularly called the yellow box in Botswana, hand-held or static readers, wands, battery, bolus applicator and the field printer.

The third component of LITS is the bolus itself, which is a micro-chip with a unique individual number. When bolus insertions take place in the field, the information is automatically captured in the field computer, and as soon as the officer reaches the office, it is downloaded to the central database at headquarters. The bolus number is linked to the name and national identification number of the animal’s owner, brand and brand configuration of the animal, zone of residence of the animal, crush pan and the animal itself and the date of insertion. (A crush pan in Botswana is the smallest epidemiological unit, where the extension officer meets farmers for vaccinations and disease surveillance; it is similar to the dip tank found in some countries.)

Cost of implementing the system

As mentioned above, among the reasons for choosing the reticular bolus as the preferred device for cattle identification in the country were its cost and its suitability for use in Botswana’s farming environment. All the costs of implementing LITS were borne by the Botswana government, which realised the urgent need to implement a traceability system compliant with market requirements. The initial cost of the system was about P200 million, which is equivalent to US$35 million, phased over a three-year period. This included the costs of all the necessary equipment, computer hardware, software development, consultancies, project management contracts and field applications for extending LITS to the districts.

One of the reasons for the choice of a reticular bolus was that the bolus is recyclable at a relatively cheap price and this would in the long term reduce costs. When new, a bolus costs about US$2.5 while a recycled bolus costs about US$1.45.

A cost recovery mechanism was agreed between the government, farmers and all the stakeholders, and a slaughter levy is charged at all abattoirs in the country to help with the implementation of LITS.

Outputs of the system

The most important output of LITS is that it has enabled Botswana to maintain her export markets, especially in the EU, which yields the highest return to the beef industry. Several audits by the EU Veterinary Authorities have confirmed the robustness of the system and its ability to trace live cattle and beef throughout the production chain. In addition to traceability reports, other information that can be generated from the LITS database includes ownership and ownership transfer reports, cattle movement reports, census reports, and details of cattle imports and vaccination.

The livestock identification and traceback system has also brought efficiency in livestock information management and the issuance of stock brands, which is now done on the spot. This is much faster than the manual system when it took several weeks to issue a brand, a delay that was very inconvenient to the farmer. The LITS database can also be used for other functions whenever the need arises; for example, it can be used to exclude imported cattle from slaughter at the export abattoirs. (The status of BSE in the country of origin of imported cattle cannot be verified by the certifying veterinarian, so it is better to exclude imported cattle from slaughter for export.) The only big problem that remains to be addressed is that LITS is not yet available on the internet and farmers do not have access to the data, although they can be given reports on their cattle by their field extension officer.
**Benefits of the system**

At the national level LITS has provided long-term security to the cattle industry by facilitating the maintenance of export markets and assisting farmers in the competition to enter new markets.

For cattle owners the benefits of LITS are that brand certificates can be issued and renewed on demand and in all regions, in contrast to the time when the brand records were kept manually and certificates could only be issued at headquarters after a delay of several weeks.

With LITS, farmers can be issued with a movement permit and change of ownership certificates immediately. Farmers can also be given their cattle records on the spot, which helps them make quick decisions on marketing.

The bolus, which is relatively tamper-proof as it is permanently present in the animal, has drastically reduced stock theft in the country. The system has also provided a quicker way of settling disputes over ownership because the bolus records offer proof of who the owners are. Data from LITS is also used to ascertain cattle ownership when farmers are paid following slaughter of their cattle at export abattoirs, and this has reduced errors in their payments.

For the government the greatest benefit of LITS is that it provides clear information about the demography of the cattle herd and accurate animal disease information to help with disease control. In addition, a simple tamper-proof identification system is available to the police and other government agencies concerned with cattle ownership.

Two cases in which LITS was used to trace cattle movements following a disease outbreak were during the foot and mouth disease (FMD) outbreak in Zone 7 in April 2006 and more recently during the outbreak in Zone 12. During the outbreak of FMD in Zone 7, LITS was used to individually trace all the 1,709 cattle that left the zone, identifying their destinations and owners. The animals were found and appropriate action taken on them. Similarly LITS was used during the recent outbreak in Zone 12, where 1,500 cattle that left the zone were traced and action taken. The LITS database was also used to compensate farmers whose cattle were destroyed to eradicate the disease.

**Challenges associated with implementing the system**

Like any new technology that is introduced, LITS presented its own problems. The most common difficulties were those associated with maintaining equipment, as most of the devices were custom designed for the LITS project and were not readily available in the market. This was the case with extension officer field computers and touch screens for these computers. It was very difficult to find replacement parts for these instruments. A contributing factor was that poor roads in farming areas caused much damage to equipment, especially to field computers.

The maintenance of the central database has been extremely poor. This service was contracted to private companies, but most of them did not have the capacity to maintain such a complex database, and their failings have led to delays in updating the database and hence generation of reports.

The boluses were not manufactured in the country but had to be imported. The delays that resulted caused a number of problems, although the support from manufacturers has always been good.
One operational problem with LITS is that it is entirely dependent on government action, and the demands of the programme are beyond the capacity of the department to effectively implement it. It is therefore important to find a way to reduce government controls over the programme, as in the long run the present system may not be sustainable. Farmers must be given a greater role in implementing LITS.

**Conclusion**

The livestock identification and traceback system has provided an avenue for the Botswana cattle industry to access international markets, and has been subjected to rigorous inspection by various trading partners with very positive conclusions. The system is continuously assessed for its long-term sustainability in terms of its cost-effectiveness and applicability in comparison with alternative systems of animal identification such as ear-tagging. It is also compliant with OIE standards and guidelines on animal identification and traceability.

The system has proved to be a powerful tool for disease control programmes, as demonstrated in recent FMD outbreaks in the country.

**Acknowledgement**

The author wishes to thank the Director of Veterinary Services of Botswana for allowing him to use information from the department when preparing this paper. Special thanks also go to Mr. K.O. Kedikilwe, the Botswana LITS Coordinator, for providing additional information and checking the accuracy of this paper’s content.
Identification and traceability: the European Union's perspective

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Summary

Farmers from all over the world and not just from Europe have, for centuries, been identifying their animals for different purposes, with their available tools in the best possible manner. However, the increase in the trade in live animals in the context with the establishment of the EU common market required harmonised rules for the identification of animals and the registration of their holdings. The increasing integration between agriculture, food processing and wholesale/retail chain requires an integrated approach to food safety. Animal identification and traceability are therefore key elements of the European Union’s strategy ‘from stable to table’, and the OIE has also given priority to animal identification systems in Chapter 4.2 of the Terrestrial Animal Health Code 2008.

The basic operational objectives for community rules on the identification of live animals are the registration of holdings, tracing of animal movements and linking animals with their sanitary/health status, all of which are of crucial importance for control of infectious diseases.

Identification and traceability systems became an essential part of the European Union’s basic infrastructure to manage animal health. In addition to the aspect of disease control, the European Union has paid particular attention to the compatibility of the different systems with the newborn electronic certification (TRACES) programme, disease eradication programmes and also with other fields like animal breeding or livestock support schemes.

For the various animal species, different rules have been adopted for bovine animals (Regulation 1760/2000), sheep and goats (Regulation 21/2004), pigs (Directive 2008/71), equidae (Regulation 504/2008) and pet animals (Regulation 998/2003), all of which share some key principles. The systems include several elements differentiated by species, notably identifiers, databases, holding registers, passports or movement documents. Community rules foresee individual traceability for ruminants and group traceability for pigs. Equidae and pets are identified by individual passports without obligatory movement recording.

The introduction of electronic identification (EID) became a very important – and in some cases compulsory – new element of the respective legal framework. Also here attention is paid to the compatibility of the official electronic identification with farm management systems in order to allow additional benefits for animal keepers.

Keywords: Animal identification – Electronic identification – EU legislation – Traceability.

Historical background

The starting point for the European Union’s (EU’s) approach to animal identification and traceability is the Union’s own internal market. The EU is far from being a single entity; it is a community of 27 distinct Member States with intense competition between producers in the various States. It is the task of the European Commission to ensure that trade takes place under safe and fair conditions. Price, quality and choice are what matter. Traceability is not a competitive issue – it is a basic precondition for trade. Two major disease crises have had a major impact on reinforcing traceability rules in the EU. The first was bovine spongiform
encephalopathy (BSE) at the beginning of the 1990s and the second an outbreak of foot and mouth disease in 2001. Both had a substantial economic and also social impact on the EU’s livestock sector.

As in other parts of the world, animal identification (ID) started in the breeding sector. Herd management and performance recording were already driving animal identification more than 50 years ago. But later on animal health elements, in particular traceability, became more important. Legislation on animal ID and traceability has been progressively developed along with the common market (see Fig. 1). While the first rules stem from 1964, detailed provisions for the main species of farm animals were established in 1992 and 1993 with the completion of the single market. Essentially the same standards for animal ID and traceability apply throughout Europe. This has been made possible by a substantial investment from both the European Community and the Member States.

![EU legislation on animal identification and traceability](image)

**Figure 1**

**Principles of animal identification and traceability in the European Union**

Identification alone does not ensure traceability. As laid down in the OIE’s Terrestrial Animal Health Code (1) and in a more general manner in ISO Standard 8402, Traceability results from recorded identifications when animals are moved, Figure 2 gives an overview of the requirements for identification and movement recording for the different species in the EU. Individual traceability for bovine animals has been in place since 1997, and individual traceability by means of electronic identification for sheep and goats is currently being introduced. Pigs are traced in groups. Equidae and companion animals like dogs, cats and ferrets are identified by passports and electronic transponders. Movements of equidae and companion animals are
not recorded – given the frequent movements these animals, a ‘real-time database’ would be a complicated undertaking.

Traceability requires clear lines of responsibility. In the EU, it is always the animal keeper who is responsible for identifying the animals, keeping an up-to-date holding register, issuing movement documents and reporting movements to national databases. Respecting these rules is a precondition for the receipt of the most important public payments for farmers, and payments may be withheld if farmers fail to respect their obligations for animal ID and traceability. Movements between Member States take place with veterinary certificates, which are issued from the place of origin and since 2004 have been recorded in an integrated Europe-wide computer network called TRACES (TRAde Control and Expert System). Such intra-Community movements of consignments of animals are entered online into the computer system by the sending enterprise. The Veterinary Authority validates the certificate within the system, and the certificate is immediately available for the veterinary authorities at the destination. This allows efficient tracing back and tracing forward in case of infectious diseases or any other incidents when consignments need to be followed (e.g. contamination of feedstuffs).

Traceability cannot be achieved without cost. It is therefore necessary that identification and traceability systems are proportionate to the objective to be achieved. Simple systems may be entirely adequate under certain conditions (e.g. group identifiers for pigs), whereas more sophisticated systems might be necessary in other circumstances (e.g. radio-frequency identification (RFID) tags for sheep). The usefulness of any database for movement recording is limited by how well it is provided with up-to-date movement reports. Only when it includes such up-to-date data does it reflect the situation on the ground. The introduction of traceability
requires a step-by-step approach that takes into account the specificities of each animal species. A basic requirement is a proper holding registration, followed by animal identification. Movement records are kept first at the holding level and then at the central level (database) on a batch basis. Central recording of movements of individual animals is always the last step. An important element is the multi-purpose use of identification systems. If the 'official tag' can be used not only for traceability but also to identify the animal – for example within a breeding scheme (herd book), eradication programme (brucellosis, scrapie) or simply for farm management – this is an important incentive for animal keepers to apply the rules properly.

**International standards**

International standards play a growing role in the field of animal identification. While the new chapter in the OIE *Terrestrial Animal Health Code* sets international standards for identification and traceability as such, some more technical standards and guidelines for identifiers have been laid down by the International Organization for Standardization (ISO) and the International Committee on Animal Recording (ICAR). In relation to electronic identification of animals, ISO Standards 11784 and 11785 were developed in 1995 so as to ensure compatibility between identifiers and readers from different manufacturers. ISO Standard 24631 of 2009 lays down test procedures for conformance and performance of identifiers and readers. Since 1995, ICAR has established and continuously updated its guidelines on animal identification methods, performance recording and genetic evaluation, in particular in the bovine sector. In 2006, quality standards for conventional plastic ear tags were published.

**Future perspectives**

Animal identification and traceability systems are not static systems. Climate change and the liberalisation of world trade will certainly pose challenges in the future. Biotechnology will further drive the livestock sector and provide new tools for traceability but also new challenges. Technical progress (electronic identification, telecommunication) will also drive the farming sector as such and not only in developed countries. Systems for identification and traceability of animals should be designed in a way that they can keep up with these challenges and contribute positively to animal health and food safety, but also to farmers’ income.

**Reference**

Cattle identification and beef traceability in Japan
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National Livestock Breeding Center, Incorporated Administrative Agency, Japan

Summary
The first case of bovine spongiform encephalopathy (BSE) was detected in Japan in September 2001. Beef consumption in Japan subsequently dropped dramatically because of consumer concerns. The Japanese Government, through the National Livestock Breeding Center (NLBC), quickly introduced a cattle identification and traceability system in order to restore consumer confidence in domestically produced beef. The establishment of the system throughout Japan was challenging; however ear tags bearing ten-character individual identification numbers were successfully attached to all cattle by June 2002. Information on individual cattle from birth to slaughter is reported to NLBC and recorded on linked databases. The system conforms with the elements in Chapter 4.2 of the OIE Terrestrial Animal Health Code ‘Design and implementation of identification systems to achieve animal traceability’.

A feature of the Japanese system is that some of the recorded information regarding cattle is made available to the public via an internet website. The individual identification number of cattle from which beef was produced must be shown on the label of packaging, or made available to consumers by the retailer.

The system is used when cattle need to be tracked for disease control purposes. For example, if a BSE infected animal is found, NLBC immediately starts a search to determine the location of cohorts and farms where infected animals have resided. The search is usually finished within a few hours, and is reported to the Ministry of Agriculture, Forestry and Fisheries enabling cattle of interest to be quickly located.

The system has helped restore the trust of consumers in domestically produced beef.

Keywords: Beef traceability and individual cattle identification system – Bovine spongiform encephalopathy – Consumer confidence.

Panic after the BSE outbreak and the decrease in beef consumption
Public concern was triggered on 10 September 2001 when the Japanese government announced the first case of a cow that was suspected to be suffering bovine spongiform encephalopathy (BSE). After that announcement, the case was highlighted every day in television programmes, newspapers, magazines and other media. This publicity increased consumers’ concerns about the safety of beef and led to a drastic fall in consumption, which in October dropped to only 42% of the level in the same month the year before (Fig. 1).

Measures taken after the BSE outbreak
After the BSE outbreak, urgent measures were required. First of all, action was taken to prevent meat-and-bone meal from being used in livestock feed. The import of meat-and-bone meal was banned and any meal produced was cremated. These measures were put into effect on 4 October 2001.
Secondly, a system was put in place to prevent specified hazardous materials from being used in food for people and livestock. Tests for BSE were to be conducted on all cattle in abattoirs. A system of removing and cremating specified hazardous materials was also introduced. This system was put in effect on 18 October 2001.

The notification of cattle that died at the age of 24 months or more was made mandatory, and a system of conducting BSE tests on such cattle without exception was also introduced. This system was put into effect on 1 April 2003.

In addition to these measures, there was strong public pressure for the introduction of a system for identifying individual cattle and for a cattle and beef traceability system.

**The individual cattle identification system, beef traceability system and the role of the National Livestock Breeding Center**

Generally, living cattle are transported from farms to abattoirs and the beef produced is transferred through distributors to consumers.

The NLBC, a governmental agency, provides individual cattle identification and beef traceability systems. To do this, it has to manage the individual cattle identification number database for all of Japan. All movements of living cattle must be notified to the NLBC without exception, and the NLBC builds data in the individual identification database on the basis of these notifications.

An individual ID number is assigned to each piece of beef produced, and the distributors are responsible for ensuring this is used properly so that the meat is fully traceable.

**Notification and the individual identification and traceability of live cattle**

When a calf is born, the farm immediately attaches ear tags to it and notifies the NLBC. When any cattle are transferred from one farm to another, this must also be reported to the NLBC, both by the farm sending the cows and by the farm receiving them. Similarly, when cows are sent from a fattening farm to an abattoir, both the farm and the abattoir also report the movement to the NLBC (Fig. 2).
It is also permissible for the agricultural cooperative union to report it on behalf of the farm.

**Notification, indication and record keeping in the beef traceability system**

From abattoirs to consumers, the distributors are responsible for ensuring traceability, placing individual ID numbers on pieces of beef or meat containers, and keeping full records (Fig. 3). When beef is transferred to other containers, the individual ID numbers must be shown on the containers and records of the change must be kept.

Vendors who purchase beef record the details on receipt of the meat.

In addition to distributors, restaurants mainly serving designated dishes such as sukiyaki, yakiniku or steak-restraint also must show the individual ID numbers.

**Ear tags and individual identification numbers**

Ear tags play a very important role in the individual identification and traceability system. Specific requirements for ear tags are therefore prescribed in the law that established the identification system:

- the tags should be designed so that they cannot easily be detached from the ear
- they should be designed so that they cannot be reattached after removal
- the individual identification number should be of an easily identifiable colour and size
- the number should be of a kind that cannot easily be tampered with, modified or erased.
Methods of notification

There are six methods of notification:
- filling in a report form and sending it by fax
- using a touch-tone phone
- accessing a website by means of a mobile phone
- accessing a website by means of a PC
- connecting the database of an agricultural cooperative union or an abattoir to the database of NLBC through the internet
- directly connecting the database of an agricultural cooperative union or an abattoir with the database of NLBC by the specified line.

It is easy to make mistakes when using the fax method, and the information will have to be digitised once it is received, so NLBC recommends that other methods are used.

Currently, about 12 million notifications are made each year (Fig. 4).

Conducting an urgent search for a BSE cohort

When BSE-positive cows are found at an abattoir or in tests of dead animals, there is a prescribed course of action (Fig. 5).
### Systems for notification

<table>
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<th>Percentage</th>
<th>Users</th>
<th>Description</th>
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</thead>
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<td>Farmers, support bodies, abattoirs</td>
<td>Notification by filling in a report and sending it by facsimile</td>
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<td>Notification by pushing numbers on a touch-tone phone</td>
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<td>Notification via the internet (e-mail)</td>
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<td>File transfer protocol</td>
<td>39.8%</td>
<td>Support bodies, abattoirs</td>
<td>Notification by connecting to the database of some agricultural cooperatives with the individual identification registers</td>
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</table>

*Note: 1) Figures in ( ) represent percentage of total notifications in FY2007.*

#### Figure 4 Methods of notification

![Diagram of notification methods](image)

#### Figure 5 Conducting an urgent search for a BSE cohort

![Diagram of search for BSE cohort](image)
The primary test is conducted by the staff of prefectural governments. Samples that register as positive at the primary test are sent to a specialised testing institute and a secondary test is conducted. When the presence of BSE is confirmed at the secondary test, the testing institute reports it immediately to the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Ministry of Health, Labour and Welfare. After receiving the report, MAFF immediately instructs the NLBC to conduct a search. The NLBC compiles the following data from the database:

- information about the BSE-infected cow
- information about the farm keeping the infected cow
- a list of calves of the infected cow
- a list of cows that were raised with the infected cow.

It also collects other data, and sends a report to MAFF. At present, reports can be sent within as little as three hours after the NLBC receives instructions from the Ministry.

**Use of individual cattle identification information**

Data sent to the NLBC are first sorted for each animal. Data recorded for each one include its individual identification number, date of birth, breed, the individual identification number of its mother cow, and its movement history (Fig. 6). At present, NLBC provides the individual cattle identification information or the statistics derived from it to local governments, to the Holstein Cattle Registration Association and to livestock insurance cooperatives.
These data have proved very useful for the people involved in the livestock industry, including the Ministry of Agriculture, Forestry and Fisheries, local governments, the cattle pedigree registration association and livestock insurance cooperatives. Local governments use the statistics to plan a range of administrative policies and measures; the Cattle Registration Association uses the database for publishing registration; livestock insurance cooperatives use it as a means to identify the owners of diseased or dead cows.

**Public disclosure of individual cattle identification information**

In Japan, beef is commonly sold at supermarkets packed in a plastic case. Information about the meat is shown on the lower right of the case in which it is packed. The label indicates the date on which it was processed, the part of the body, weight, price, name of processor and individual identification number (Fig. 7).

![Figure 7 Public disclosure of individual cattle identification information](image)

**Searching for information about specific individual cattle using a personal computer**

Everybody can access the website that holds the individual cattle identification information by using a personal computer (PC) or a mobile phone. Information is displayed on the screen in a form that shows the animal’s breed, date of birth, date of movements, destination of movements and other data (Fig. 8). Currently, around 90,000 to 110,000 searches are made each day by means of PCs, and 6,000 to 7,000 by mobile phone.
Public awareness of the individual cattle identification system

A survey was conducted to find how many people were aware of the system five years after its introduction. The respondents were asked: ‘Did you know that there is a system for searching?’ Nearly two-thirds (62.8%) answered ‘Yes’, and 2.9% said they had actually made a search (Fig. 9).

Figure 9 Public awareness of the individual cattle identification system

Source: [1]. Note: results of a questionnaire survey administered to 2,102 families


**Appreciation of the beef traceability system**

In a survey asking ‘Should these systems be kept?’ 81% of respondents answered ‘Yes’ (Fig. 10). They gave the following reasons:

- ‘We can eat domestic beef with a feeling of security’: 72%
- ‘It makes proper labelling of beef possible’: 51%
- ‘The spread of BSE can be prevented’: 41%.

It was for the third of these reasons – to combat BSE – that the law introducing individual cattle identification and beef traceability systems was enacted. However, it seems that consumers also want the information so that they can eat beef with confidence in its safety.

**Figure 10 Appreciation of the beef traceability system**

Source: [2]. Note: results of a questionnaire survey administered to 1,575 people.

**Requests for changes in the individual cattle identification and beef traceability system**

Although five years have elapsed since the introduction of the individual cattle identification and beef traceability systems, we still receive a range of requests for additional information or for modifications:

- some consumers want data about the feed and drugs given to cows to be included;
- farmers and distributors have asked that electronic ear tags should be introduced instead of regular ear tags;
- a combination of these systems with drug dosage history and beef quality data has also been requested;
– some distributors want to use the individual identification information as a means to indicate the place of origin. In Japan, it is very important for distributors and consumers to know where beef has come from, because premium beef – Kobe beef, for example – must come from cattle that have spent most of their lives in a specified area. Therefore, distributors want a guarantee that cattle have been raised in particular places.

In addition to these requests, the National Livestock Breeding Center also has concerns, such as the need to improve reporting methods and security systems. For these reasons, the systems have not yet reached their final development stage. Improvements will be made through a process of widespread discussion and consultation.

References
Session 5

Private Sector Perspectives and Experiences

Chair: Mr Dardo Chiesa
President, Argentine Beef Promotion Institute (IPCVA), Argentina
Australia's system for identifying and tracking cattle

J. Wyld
National Livestock Identification Scheme (Cattle), Australia

Summary
Australia is a relatively small beef-producing nation, and yet it is a major world beef trader. Some 65% of Australia's beef production is exported. As a consequence, Australia places great importance on its reputation as a reliable supplier of clean, safe product.

Australia's official cattle identification system began in the 1970s with the registration of properties, and the use of fire branding, tail tagging and paper-based records to track cattle for disease control purposes. By the early 1990s, the limitations of these arrangements became apparent during incidents when large numbers of cattle had to be traced quickly.

In 1996 a decision was made between the Government and industry that Australia needed a 'whole of life' identification and tracking scheme, based on the use of machine-readable devices.

The National Livestock Identification System (NLIS) was developed, and then mandated across Australia from 2002 by all State Governments. NLIS involves the individual electronic identification of cattle, and the recording of all their movements through a single database operated by the producer-controlled Meat and Livestock Australia.

NLIS is now used routinely by Government agencies for disease control, food safety and market access purposes.

Apart from these obvious advantages in tracing, the individual radio frequency identification (RFID) technology has also provided opportunities for efficiency gains and information flow along the supply chain from producer to meat processor.

New uses for the technology on-farm have been developed, and these will continue, giving rise to new and innovative management techniques.

The NLIS has been introduced successfully throughout Australia as a result of the partnership and sound working relationship that exists between industry and Governments.

Keywords: Cattle traceability – Electronic tagging – Radio frequency identification.

Background
In the early 1990s, the cattle industry in the state of Victoria, Australia was affected by a contamination incident where cotton plant material (known as cotton trash) that had been sprayed with a pesticide was fed to cattle in the states of New South Wales and Queensland. Some contaminated cattle had entered Victoria but could not be tracked because of the limitations of the tail tag and paper-based system in place at the time. Tail tags are adhesive strips of vinyl tape printed with the property identification code (PIC) of the property of dispatch that are wrapped around the tails of cattle prior to transportation. Tail tags fall off within a few days of attachment.
The cattle industry throughout eastern Australia had to introduce expensive testing procedures in response to the cotton trash contamination incident.

Following this incident, in 1995, Victoria led a national government/industry working group set up under the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) that designed a 'whole-of-life' identification and tracking scheme for cattle based on the use of machine-readable permanent identification devices. The scheme has subsequently become known as the National Livestock Identification System for cattle (NLIS [Cattle]). The working group also drafted the National Vendor Declaration (NVD), which is a form outlining the chemical treatment and exposure history of cattle, which vendors throughout Australia routinely complete when consigning cattle for sale or slaughter.

The national Standards Committee developed a draft set of requirements that would suit Australian conditions, and be able to operate without any undue impedance of trade, and be cost-effective.

Victoria conducted an international tender for machine-readable ‘whole-of-life’ identification devices that would meet the Standards in late 1997. The successful tenderer was Allflex Australia Ltd with its button ear tag. Each tag contains a half duplex (HDX) ISO11784/11785 compliant transponder encoded with a unique unalterable number that can be read in a fraction of a second by cattle producers and in saleyards and abattoirs, using panel or wand readers.

The first NLIS devices were released to Victorian producers who wished to use them on a voluntary basis in February 1999.

In mid-1999, the European Union (EU) advised Australia that the tail tag and paper-based system in use nationally at the time was not sufficiently robust to enable cattle to be tracked reliably from an abattoir back to their properties of birth. As a consequence, it was agreed nationally that the NLIS should become mandatory for all cattle destined for processing for EU markets from late 1999. The NLIS database was set up within Meat and Livestock Australia (MLA, a producer-owned corporation created under the Commonwealth’s Meat and Livestock Corporation Act 1977) as a result. Use of NLIS devices remained voluntary for other classes of cattle.

Following the foot and mouth disease (FMD) outbreak in Europe in 2001, cattle industry organisations realised that the prompt tracking of animals that had been exposed to the virus would be critical if the disease is ever diagnosed in Australia. Aware of the consequences of a disease outbreak such as FMD or another issue similar to the ‘cotton trash’ incident, key Victorian industry organisations requested that the government review whether the NLIS should remain as a voluntary system. In response, the then Victorian minister for agriculture convened the NLIS Implementation Advisory Committee, which includes representatives of all stakeholder organisations, to formulate an implementation plan and monitor the operation of the scheme. This committee has subsequently met regularly, and provides advice on the operation of the NLIS (Cattle) in Victoria.

Each state in Australia formed a similar committee, to develop policy and timetables pertaining to the national system.

In mid-2001, the Victorian Committee unanimously recommended that the government should progressively introduce legislation requiring that producers attach an NLIS device to the cattle they breed before these cattle leave their properties of birth. An amendment to Victoria’s Livestock Disease Control Act 1994 to facilitate the implementation of the NLIS was subsequently passed by Parliament in late 2001 with bipartisan support.
Regulations have also been progressively introduced requiring that cattle be scanned at saleyards, abattoirs and knackeries, and more recently when they are moving directly between properties, and movements details are registered on the NLIS database.

In recent years bovine spongiform encephalopathy (BSE) has been diagnosed in Japan, Canada and the United States of America. As a result, questions of food safety and the associated ability to locate potentially affected animals quickly and accurately emerged as major issues for livestock industries throughout the developed world. Mindful of these developments, in May 2004 Australia’s Primary Industries Ministerial Council (PIMC) recommended the progressive introduction of mandatory cattle identification and scanning arrangements in all Australian states and territories by mid-2005. The NLIS (Cattle) is now mandatory in all Australian jurisdictions.

**Data management**

Since the 1970s, the Australian states and territories have registered cattle-producing properties and have allocated to each property a PIC. More recently the states and territories have commenced registering pig, sheep and goat-producing properties.

MLA operates the national NLIS database. The database holds information regarding an animal’s history, its movements from PIC to PIC throughout its life, and a range of statuses. Statuses assigned to NLIS-identified cattle and to cattle-producing properties by the states and territories can relate to specific disease or residue risks as well as to the eligibility of cattle for processing for certain markets such as the European Union.

The NLIS database is a web-enabled system, which allows stakeholders to only access data they are entitled to view, and to only make changes where permitted. Each stakeholder group has different access screens and different functionality. Information on the operation of the NLIS database is available at www.nlis.com.au.
Because NLIS devices can be read, and information stored and transmitted electronically via the internet, manual recording and input of information into the database is minimal. Over 99% of all data into and out of the database is in electronic form.

The NLIS database is currently receiving and processing details on approximately 1 million cattle movements per month. The states and territories can retrieve this information for tracking purposes within a few seconds.

Victoria’s Department of Primary Industries (DPI) has recently gained access to a complete copy of cattle-movement information held on the NLIS database. This data is updated on a daily basis, and could potentially be updated more frequently in a disease or food safety emergency. DPI is developing an innovative system to enable the visualisation and analysis of data held within DPI’s property registration system, complemented by NLIS information about the movement of cattle. This system will enhance Victoria’s ability to respond to a disease or food safety emergency. Other states also understand the value of holding a copy of the NLIS database locally so as to respond more effectively to an emergency.

**NLIS (Cattle) technology**

NLIS (Cattle) devices can take the form of either an ear tag or a rumen bolus. Boluses are ceramic capsules which each contain a transponder. When administered orally, they lodge permanently in the animal’s reticulum. Subcutaneous and intramuscular implanted transponders are not permitted as part of the NLIS (Cattle) because of the potential for them to contaminate beef products.

Over 99% of the devices currently being used by producers to identify their cattle are ear tags.

The transponders used in NLIS (Cattle) devices comply with relevant international standards for animal identification technology known as ISO 11784 and ISO 11785. These standards allow for two different forms of transponder known as full duplex (FDX-B) and half duplex (HDX). The transponders used in NLIS (Cattle) devices are all HDX due to the superior performance of this form of technology in relation to electronic reading on-farm and in saleyard and abattoir environments.

NLIS devices must comply with a national standard which focuses on issues such as the field retention of devices, technology platform, transponder reliability, and colour and numbering arrangements. The standard is overseen by a national committee known as the NLIS Standards Committee. MLA accredits manufacturers, and issues a licence to supply a particular NLIS device.

Reading equipment is not accredited, and market forces determine appropriate installations to suit individual requirements.
Commercial opportunities

While the main driver for the introduction of the NLIS (Cattle) is the need to protect and enhance Australia’s reputation as a supplier of safe disease-free beef and dairy products, there are very significant on-farm benefits associated with the use of NLIS technology through the ability to establish the identity of individual animals quickly and accurately.

The dairy industry in Victoria has welcomed NLIS technology because of the opportunities the technology provides to enhance cow identification, improved and simplify herd recording, and facilitate the operation of automated feeding and drafting systems.

For beef producers, NLIS technology provides the opportunity to improve the efficiency and accuracy of data capture and herd information management. Information such as weight gain or loss, reproductive performance and veterinary treatment history can easily be collected and used for decision making. There are opportunities to better market stock ahead, because of the improved knowledge of individual performance, and to therefore target specific end users and gain premiums.

Feedlot operators and abattoirs are also benefiting from the NLIS through better inventory control and from the marketing opportunities associated with the integrity that the NLIS provides.

Industry and government representatives from the USA, Canada, Europe, New Zealand, South Korea, China and Japan are regularly visiting Victoria to inspect NLIS installations on farms, and in abattoirs and saleyards. Victoria is acknowledged as a world leader in the use of electronic cattle identification and tracing technology.

DPI Victoria (and MLA and other states) have produced a range of brochures and DVDs explaining the operation of the NLIS (Cattle) for the benefit of industry participants and overseas customers.

Cowcatcher II

A national exercise to test the operation of the NLIS was conducted in mid-2007. The exercise was known as Cowcatcher II. A copy of the Cowcatcher report is available by visiting www.daff.gov.au, and then typing Cowcatcher into the search function.
An enhanced animal identification and traceability information system in Namibia: production sector perspectives and experiences in a developing country

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Summary

In order to retain access to high-value beef markets, the Namibian livestock industry, which is export-dependent, had to meet growing the demands of international trading partners for beef traceability. In 2004, the industry in close partnership with the government initiated an enhanced system for animal identification and traceability which is supported by a computerised information management system. The primary drivers for establishing the system were compliance with European Union beef traceability requirements, verification of the Farm Assured Namibian Meat, a beef and lamb quality assurance scheme, and supporting risk management of trade-sensitive animal diseases.

This enhanced system was built on the long-existing system for group identification of cattle, sheep and goats, and a veterinary movement permit system that has been in place since the late 1960s. In addition to lot identification of cattle based on the owner's registered stock brand symbols, cattle are identified individually when they leave their herd of origin using ear tags. The cattle identification system in Namibia is currently being extended to include on-farm individual identification and registration of cattle aged six months and older. In the case of small ruminants, lot identification has been retained using either ear tags or an ear tattoo. A computerised database has largely replaced the manual information system.

Public–private partnership was key to the successful development and implementation of a functional animal identification and traceability system. Although enforcement and general oversight is the sole responsibility of the Veterinary Authority, management responsibilities are shared with the industry. Most of the components of the system are already in place and functional. However, it is still a work in progress. For the Namibian beef industry, implementing a credible livestock identification and traceability information system is a matter of not choice but survival.

Keywords: Animal health assurance – Beef exports – Private–public partnership – Traceability.
US pork industry implementation of animal identification: successes, challenges and what is yet to come

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Summary
The introduction of a foreign animal disease, such as classical swine fever or foot and mouth disease, into the US swine herd would have an immediate and drastic effect on the commerce of live pigs, pork and pork products. Exports currently account for approximately 25% of US pork production. Nationally, aggressive disease control measures enacted by animal health authorities to prevent further spread of the disease will affect the movement of live pigs, fresh pork and pork products locally and interstate. According to the United States Department of Agriculture (USDA), the entry of a serious foreign animal disease could cause estimated US economy-wide losses of up to $40 to 60 billion as a result of the destruction of animals and the loss of exports until our export markets reopen.

USDA defines retrieval of animal traceback data to their last premises of holding within a 48-hour window as optimal for efficient, effective disease containment. The National Animal Identification System (NAIS), developed in partnership with the animal agriculture production industry, State animal health authorities, and USDA, provides the common data standards required to close traceability gaps.

NAIS is comprised of three components: premises registration of locations that manage livestock or poultry (farms, feedlots, veterinary clinics, and livestock markets); animal identification (either individually or as groups) using an approved method prior to their commingling with animals from other premises; and animal tracing or recording animal movements from one premises to another in private and state animal tracking databases using standard data fields and data transfer.

In 2006 and 2008 the US swine industry entered into cooperative agreements with USDA to help fund the industry’s effort to fully implement premises registration. As of January 2009, USDA estimates that there are 1,438,280 animal premises in the USA and 501,428 or 34.9% of them are registered. For the US pork industry, there are an estimated 67,280 swine premises with 52,747 or 78.4% of them registered.

The pork industry has had a functional, mandatory swine identification system in place since 1988. This system requires that all swine in interstate commerce must be identified and records concerning these movements be reported to federal and state databases.

In July 2005, the US swine industry developed a consensus document outlining standards by which the swine industry intends to implement a national swine identification system. The swine industry’s proposal focuses on adapting the existing federal identification regulations as a model for a national swine identification system.

The US swine industry is a stakeholder in developing a successful plan for enhancing current animal movement record requirements. The goals include retention of data necessary for a 48-hour trace-back for animal health issues and accessibility by state and federal animal health officials.
Premises registration and the Swine ID Plan enables the industry to be effective in pre-planning efforts for the introduction of foreign animal or emerging animal disease and to rapidly contain and appropriately respond to the introduction of foreign animal or emerging animal disease into the USA should that happen.

Keywords: Foreign animal disease – National Animal Identification System (NAIS) – United States Department of Agriculture (USDA).

The introduction of a foreign animal disease, such as classical swine fever or foot and mouth disease, into the swine herd in the USA would have an immediate and drastic effect on trade in live pigs, pork and pork products. Exports currently account for approximately 25% of pork production in the USA.

The estimated number of commercial pork production premises in the USA is greater than 67,000, and the majority of pigs produced are raised on farms which sell more than 5,000 pigs to market each year. Farm sales from pigs result in an annual $15 billion contribution to the economy of the USA, with a total annual economic impact of $97 billion. According to the USDA, the entry of a serious foreign animal disease could cause estimated economy-wide ongoing losses in the USA of up to US$40 billion to US$60 billion due to the destruction of animals and the loss of exports until our export markets reopen.

Nationally, aggressive disease control measures enacted by animal health authorities to prevent further spread would affect the movement of live pigs, fresh pork and pork products locally and interstate. Although pork production operations are found in most areas of the USA, production is primarily centred in the Midwestern sections of the country close to the sources of grain production. For example, Iowa currently markets about 25% of the yearly pig supply, which was approximately 118 million head in 2008.

There is also a concentration of production, primarily breeding and farrowing, on the east coast in North Carolina. Because of the trend to address animal health issues through segregation of the different phases of production, even as far as from one region of the country to another, and the movement of pigs to abattoirs, it is estimated that within a five-day (working week) period there could be as many as 625,000 pigs or 1,750 to 2,000 semi-truck loads on the nation's highways.

The USDA defines retrieval of animal traceback data to their last premises of holding within a 48 h window as optimal for efficient, effective disease containment. The National Animal Identification System (NAIS) developed in partnership with the animal agriculture production industry, state animal health authorities and USDA, provides the common data standards required to close traceability gaps. Its goal is to provide animal health authorities with the ability to rapidly identify all premises and at-risk animals that might have been exposed to a disease of concern. The identification of animals is technology neutral – enabling the identification method used to be appropriate and implementable for the species of animal and for the abilities of the producer.

NAIS is comprised of three components:
- premises registration of locations that manage livestock or poultry (farms, feedlots, veterinary clinics, and livestock markets)
- animal identification (either individually or as groups) using an approved method prior to their commingling with animals from other premises
- animal tracing or recording animal movements from one premises to another in private and state animal tracking databases using standard data fields and data transfer.
In 2006 and 2008 the swine industry in the USA entered into cooperative agreements with USDA to help fund the industry’s effort to fully implement premises registration. The funds were used to hire three regional premises identification coordinators who had the responsibility of facilitating pork production premises registration with the state animal health authorities. By 2009, the situation had evolved so there was one national swine identification programme manager with the same intent on a national rather than regional scope. Resources at the National Pork Board and other allied industry partners have also been used to support this mission.

In January 2009, USDA estimated that there were 1,438,280 animal premises in the USA and 501,428 or 34.9% of them were registered. For the pork industry in the USA, there were an estimated 67,280 swine premises, with 52,747 or 78.4% of them registered.

The pork industry has had a functional, mandatory swine identification system in place since 1988. This system requires that all swine in interstate commerce must be identified and records concerning these movements be reported to federal and state databases. In July 2005, the swine industry in the USA developed a consensus document outlining standards by which the industry intends to implement a national swine identification system. The swine industry’s proposal focuses on adapting the existing federal identification regulations as a model for a national swine identification system.

It is expected that market influences will have an increasing influence on the implementation of a full accounting of the pork production premises in the USA. For example, the Pork Quality Assurance Plus programme is a producer educational programme that gives producers and their veterinarians or other animal health experts an opportunity to review herd health data, animal health product use and animal care procedures on the farm, and to develop farm-specific plans to ensure responsible production. One requirement of the programme is the registration of the premises with the state animal health authorities. All major packing companies in the USA require of their producer suppliers Pork Quality Assurance Plus certification and premises site registration, either through verification at the time of spot marketing or through contractual relationships.

Premises registration and the Swine ID Plan are key elements in a comprehensive swine disease surveillance system that will enable surveillance for endemic disease, the early detection of emerging disease or the introduction of foreign animal disease. Effective endemic disease surveillance is important to maintaining herd health and improving herd and site biosecurity. Premises registration, the Swine ID Plan and a comprehensive surveillance system also enable the industry to be effective in preparation for, the rapid containment of and the appropriate response to the introduction of foreign animal or emerging animal disease into the USA should that happen. Response, containment and recovery are essential components of the ability of pork producers to continue business.
Summary

The Brazilian pork industry is organised along lines that are consistent with the World Organisation for Animal Health (OIE) international standards for swine health and in full recognition of the need to provide its customers with high-quality pork. On that basis, investments have been made to improve industry processes, biosecurity and traceability systems, providing for transparency in the activities of the private sector and of the official veterinary services, and ensuring that Brazilian pork can be certified as a healthy and safe food that is suitable for all markets around the world.

On Brazilian pig farms several tools are applied to prevent and manage animal health problems, which is essential to support export certification in compliance with the OIE international health standards. The industry aims to satisfy the requirements of both domestic and overseas markets.

In Brazil, pigs are reared and processed using an ‘Integrated production system’, which provides for the development and implementation of measures for animal health and food safety. As well as safeguarding pork production, the measures are intended to build an enhanced awareness throughout the production chain concerning the maintenance of animal health standards, which are vital for industry growth for business and for commercial markets. This is the basis for the strong industry commitment to apply identification and traceability systems for pigs and for pig products, in accordance with OIE standards.

The competitiveness of the Brazilian pork sector and industry commitment to implement international standards have made Brazil into a leading producer globally.

Keywords: Pig identification – Traceability – World Organisation for Animal Health (OIE) standards.
**Animal identification and traceability: industry perspectives and experiences**

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**Summary**

Today, consumers are not only concerned about food safety and quality but they are also concerned about ethical values such as the respect for the environment and animal welfare. The best way to meet these consumer demands is to assure the control of the whole productive process. In the poultry industry, it can be done by the animal traceability (in the case of birds the group) during all stages of its life (1) and by the traceability of its products. Such a control system requires an identification system to monitor the origin of animals, the farmer, raw materials and feed used and slaughterhouse procedures. The traceability system provides a management tool for poultry production, a way to assure food safety, and a tool for disease control programmes, such as Avian Influenza and Newcastle Disease, two devastating diseases of poultry. A successful traceability system provides market opportunities for poultry products by ensuring effective and transparent operations throughout the food chain and compliance to the animal health, food safety and animal welfare requirements for international trade. For the poultry sector which is the largest segment of livestock production, traceability should be introduced, expanded and continuously improved to ensure we achieve the best quality controls that can be incorporated into the human food supply chain.

**Keywords:** Animal identification – Poultry production – Traceability.

**Introduction**

Nowadays, consumers around the world are becoming more aware of the way their food is produced and where it is produced. This has increased the demand for safe food items, along with an increased focus on other issues such as care of the environment and the impact of the production process for a given food item on the environment.

The animal industries involved in the production of animal protein for human consumption face a number of demands from consumers. Consumers want them to use a transparent and ethical way of producing safe food, and they also demand that the animal industry take actions to tackle environmental issues and thus reduce the impact on the environment of rearing animals for food. Along with that, consumers demand a more 'animal friendly' way of producing meat, eggs and milk.

The concept of animal identification and traceability has been proposed as a way to make it possible to trace back the movements of a diseased animal in order to hamper the spread of a particular disease, and at the same time, eliminate or diminish the possibility of products from that animal entering the human food chain. If steps are taken to prevent products of diseased animals from entering the human food chain, it is argued that food will be safer. The goal of the concept of identification and traceability is to be able to detect and trace back the movement of a diseased animal or contaminated food items within 48 hours.
In the USA, the implementation of the identification system proposed originally by the Department of Agriculture of the USA (USDA) would require two basic numbers, one that identifies the premises and a second that identifies the exact animal in question. Both numbers would be unique to the premises and animal(s). There is a 7-digit number for the premises, and 12 digits are used to identify groups of animals that are handled as a batch rather than individually, such as poultry.

Due to the level of complexity of the two main sectors of the poultry industry (egg or meat production), this presentation focuses on the sector concerned with birds for meat. A different presentation addresses the industry perspectives for the egg sector.

The poultry industry situation

The poultry industry is considered as a mature industry from the viewpoint of its level of integration. In other words, the levels of control that a given company has over the different factors involved in the production of poultry meat (feed, breeding stock, incubation facilities, baby broiler chicks, processing, further processing, packaging, distribution and retail) are those of a mature industry. The more control a given company has over the factors that play a role in the production of meat, the more integrated and more efficient the business might be. This gives a business more ability to control the marketing and distribution of its products.

The poultry industry is considered as mature in this regard because it has achieved a high level of integration. This is reflected in a high degree of consolidation. The system allows for the development of big companies that lead the field in the production of animal protein foods in developed economies and the international market.

Because broiler chickens are maintained as flocks throughout their entire life, with all the birds being reared under similar conditions (housing, feed, water, and management in general), the flocks are commonly processed together as well, and in the modern poultry industry there are commonly thousands of birds in each flock, birds are not normally identified individually in commercial operations. Rather, it is the flock or batch that is identified.

Individual poultry identification is practised only for elite breeding stock. However, the commercial sector of the poultry industry in developed countries exercises such a high level of integration, automation and operation procedures that it is normally possible to trace back a poultry meat product to a lot or flock of poultry. In the worst case, it is possible to come very close to identifying the precise flock of origin after minor adjustments. Most major integrators already have the ability to trace back to a flock of poultry from a pack of product leaving either initial or subsequent processing facilities.

In the USA, for example, industry integration, as explained before, leads traceability through coordinated efforts throughout the production and distribution chains by private sector. Those actions are coordinated by the official sector in countries like those in the European Union, where levels of integration are less, but the poultry industry shows high levels of sophistication in terms of equipment and procedures. In these two scenarios, the flock and premise identification allow for an effective traceability of poultry meat and products for the safety of consumers.

In the other direction, if a flock of birds is found to be infected, or contamination is discovered in a product at a processing facility, the steps required to track forward the product are in place. Integrators have different operations in place in order to establish a recall system once a product has been identified as unsafe. The integrators have the ability to identify the exact
product distribution path, and this means that when recall is necessary, there can be a quick response and increased effectiveness of the recall process.

Under these two scenarios – that is, forwards and backwards identification in the supply chain – the facilities proposed by this project have already been attained. It is the uniformity and standardisation of the identification procedure that now needs to be organised. Farm and house identification are considered part of the standard operation procedures for most poultry companies; however, there is no standard system in place at an international, national or even company level.

Concerns

Some opposition has been expressed regarding animal identification and traceability in the poultry industry. This relates to the following concerns. First, the extent of the programme makes it necessary to define the size of a flock or farm to be registered. This is of particular interest with regard to small flock or farm size. ‘Backyard’ flocks (small groups of birds reared informally) and more formal free-range production systems are more likely to be exposed to wildlife than large flocks reared in more industrialised conditions. At the same time, a small producer is less likely to have a health monitoring programme in place, or if he does, it might not be as extensive as that of a large modern poultry farm.

The adoption of the all-in, all-out system by the modern poultry industry has allowed for a more effective disease control and prevention, but it also favours identification and traceability. Alternative methods of production may face additional challenges to implement all-in, all-out systems with the corresponding implications for identification and traceability.

In the commercial sector of the poultry industry in developed countries, the ‘uniform’ production unit can be defined by the following factors:

- flock size: regularly between 20,000 to 60,000 birds
- chickens processed in batches of at least 5,000 birds each or complete flocks
- line speed (at processing) of between 6,000 and 12,000 birds/h
- batches kept separate from each other at least until washing and grading.

The poultry industry in developing countries is not necessarily at the same level of sophistication. It operates at a wide range of scales, with flock sizes from as small as a few hundred chickens per house to approaching 20,000 chickens per house. Farm size is also very variable, and farmers frequently depend on different companies for supplies, including feed and broiler chicks. With a lower level of sophistication and higher number of participants in the chain from farm to retail, the ability to apply traceability in a timely and efficient manner is more limited.

The implementation of this system will generate some costs that will need to be covered by either the consumer or someone along the production line.

Considering that the ultimate goal for this system is to be able to trace poultry products back and forth between farm, processing facility and retail package in the event of any health or safety concern, it has to be born in mind that the testing of each batch of chickens for every possible infection or residue is not economically possible. Thus, only a few target diseases (e.g. avian influenza, exotic Newcastle disease) and/or agents that cause safety concerns (e.g. *Salmonella enteritidis*, *S. typhimurium*) are to be included in a programme. The selection of disease and agents will depend on the requirements for both the country of origin and the importing country.
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Because the modern poultry industry in developed countries is highly sophisticated, it should not be difficult to implement an identification and traceability system. However, there are concerns regarding the enforcement of the system by means of proper audits, and it is necessary to decide on the entity in charge of conducting such audits and who will bear the cost of their implementation. It may be more challenging to implement a similar system in the poultry industry in developing countries, because of the wide range of conditions found. Worldwide, the poultry meat industry ranges from well-integrated production chains such as those found in Brazil, the USA, the European Union and Thailand, to a totally underdeveloped status in other countries. The lack of development will bring a bigger challenge.

The widespread implementation of an animal identification system may help trade in the event of outbreaks of notifiable avian influenza or other diseases of economic importance such as exotic Newcastle disease. However, this issue is being addressed by the concept of compartmentalisation. As a result, this part of the animal ID system may be redundant in cases where the compartmentalisation principles have already been implemented. Both systems can be complementary, however. The compartmentalisation concept applies to situations where a specific disease of interest has occurred, but those compartments that prove their status free of that disease are allowed to continue trading. The status of freedom from a specific disease is not only based on laboratory testing but also determined through audits focused on biosecurity and standard operation procedures. Here traceability plays a role based on farm and flock identification as well as record keeping.

Conclusion

Countries in which the poultry meat industry already has in place compartmentalisation principles or an identification and traceability scheme, or is working on developing one of these two concepts, have a better chance to continue their trade in poultry goods when diseases occur. Those countries that are behind in their procedures will have to work harder if they are to maintain their level of trade, and are more likely to have to wait for a longer time before they see the benefits of such practices.

In many countries, flock identification for the poultry industry is already in place, as are a whole set of procedures with the ultimate goal of traceability, back and forth, between farm, processing facility and retail store. Uniformity of systems applied to a more universal level might be the main challenge.
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Reference

Identification and traceability in the Norwegian aquaculture industry

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Summary

Fish farming is a substantial export industry in Norway. To maintain its international market share the industry has to be highly adaptive to new market demands. An increased number of requests for documentation on food safety and animal health have been reported in the last few years. To generate such information, traceability of products and information must be in place throughout the supply chain.

The Norwegian fish farming industry has already established effective electronic systems for the traceability of fish and fish products. A European project investigated the status of chain traceability in the Norwegian fish farming industry in 2004–05 and highlighted acceptable internal traceability systems, but insecure and partly missing chain traceability systems (14). At the production stage, live fish are identified at the group level, based on individual cages, boat cargoes or harvest batches. The industry does not implement individual identification of fish. Internal traceability is recorded in production management software applications. Essential production information, including conditions relevant to animal welfare, is recorded in the same software application. Information on animal health is thus readily available from the fish farms. All functionalities mentioned are consistent with the Article 4.2.3 of the OIE Terrestrial Animal Health Code (16) and the design criteria in section 3 of the Codex Alimentarius Commission (CAC) Principles for traceability (2). The design and functionalities of the internal systems used for traceability are in accordance with principles in international standards and established ‘good traceability practice’ (3, 10, 14).

‘The enforcement of chain traceability implies the development of systems providing information on the entire life cycle of food products, “from the farm – or the sea – to the fork”, or indeed the other way round’ (14). A Norwegian case study of implementing electronic chain traceability in the fish farming industry concluded that there are significant complications associated with such a process. The study defined eight criteria that are important for effective accomplishment of electronic chain traceability (11).

The principles of traceability (3, 10, 14), and the experiences for implementation in the aquaculture industry (13, 15) are regarded as generic for food business operators worldwide. Thus, they may be used as guidelines for establishing sector-specific traceability principles and implementation guidelines for terrestrial food industries.

Keywords: Aquaculture – Chain traceability – Fish farming – Identification – Implementation software – Norway – Salmon – Traceability.

Farming of salmon (Salmon salar) and trout (Oncorhynchus mykiss) is a substantial export industry in Norway. In total 278,000 metric tonnes were exported in 2008 with a value of almost US$3.4 million. The structure of the industry includes both large multinational companies and small and medium-sized companies. The typical supply chain of Norwegian fish farming includes five links covering all stages from breeding to harvesting. Another important part of the chain is fish feed production, including production of fishmeal, fish oil and other feed nutrients. Major customers of the Norwegian salmon farmers are fish processing companies. These processors make ready-to-eat products for consumers, which are sold on further to
wholesalers, retailers, hotels and catering companies. The total supply chain is presented in Figure 1, and a typical example of a marine salmon farm in Norway is shown in Figure 2.
Importers of Norwegian salmon worldwide request information about product quality and the history of the product. An increased number of requests for documentation on food safety and animal health have been reported in the last few years. A robust and precise traceability system is a prerequisite for enabling easy access to such information.

The definition of traceability that is most often used for food traceability is found in ISO 8402: 1994 Quality management and quality assurance – Vocabulary (8): ‘The ability to trace the history, application or location of an entity by means of recorded identifications.’ Note that in the newer ISO 9000: 2005 (9), ‘recorded identifications’ are no longer mentioned, which means that it is slightly less specific and therefore less applicable for the food industry (14).

There are some prerequisites for establishing traceability according to ISO 8402: 1994:
- unique identification of trade units (TUs)
- internal traceability
- chain traceability.

To achieve referential integrity and true traceability, globally unique identification of each trade unit has to be in place (1, 3, 6, 11, 12, 14). To trace ‘the history, application or location of an entity’ throughout the complete supply chain of farmed fish requires information from both internal processes in a food business operator (internal traceability), and information exchanged between food business operators (chain traceability) (11, 13, 14). These prerequisites make it possible to record relations between uniquely identified trade units throughout a supply chain. The processes of a food business operator that receives input factors as product sources from multiple suppliers and delivers finished products to multiple customers are presented in Figure 3. To be able to document a relation table between sources and deliveries as presented in Table I, unique identifications of trade units are necessary. These principles are generic for traceability of any commodities and food items, and thus create a set of fundamental principles that may be used for establishing any sector-specific food traceability.

Figure 3 Processes of a food business that receives inputs from multiple suppliers and delivers products to multiple customers
The Comité Européen de Normalisation (CEN) standard ‘TraceFish’ (3) defines what information should be recorded for all fish farming food business operators, as presented in Figure 1. The TraceFish standard has now terminated after six years as a CEN standard. A new ISO standard under development, ISO/DIS 12877 (10), makes use of the structure of the TraceFish standard and follows the fundamental principles mentioned above. Other independent works that confirm these principles are the ‘Can-Trace’ standard (6) and the Norwegian governmental traceability project ‘eSporing’ (4).

The Norwegian fish farming industry has established effective electronic systems for the traceability of fish and fish products. The design and functionalities of this system are mostly in accordance with the CEN standard ‘TraceFish’ (3) and ISO/DIS 12877 (10). The traceability systems are based on the principles of unique identification of TUs and the documentation of relationships between the TUs.

The batch size differs throughout the supply chain. At the production stage, live fish are identified at the group level, based on individual cages. The transport boats that carry live salmon from the fish farms to the harvesting plants (known as wellboats) also identify the fish based on groups or boat trips. The harvesting plants identify the fish by harvest batches. The industry does not implement individual identification of fish. This a normal practice regarding bulk products (5).

The most used traceability relationships are presented in Table II.

<table>
<thead>
<tr>
<th>Source trade unit ID</th>
<th>Relations</th>
<th>Delivered trade units ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>6,000</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>7,000</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>8,000</td>
</tr>
</tbody>
</table>

Source: modified from (13)

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The most used traceability relationships are presented in Table II.

The identification of TUs and relationships between TUs are recorded in production management software applications. About 99% of the fish farmers and all processing plants use software systems. This is not required by regulations, but established by the industry as a tool to enable easy and rapid reports on traceability and production statistics. It also enables production optimisation. There are also technical solutions for sending through reports to the Directory of Fisheries using portable document format (PDF) or extensible markup language (XML).

Essential production information, including conditions relevant to animal welfare, is recorded in the same software application. Information on animal health is thus readily available from the fish farms. All functionalities mentioned are consistent with the Article 4.2.3 of the OIE Terrestrial Animal Health Code (16) and the design criteria in section 3 of the Codex Alimentarius Commission (CAC) principles of traceability (2).

This level of traceability has not been in place since the establishment of the industry in the 1980s. Both the production processes and the recording of identifications have changed considerably since the mid-1990s. The central driving factors are market demands from international customers and the industry’s request for production optimisation tools. Today
### Table II Overview of main trade units, production units, identification of units and relationships between units in the fish farming supply chain in Norway

<table>
<thead>
<tr>
<th>Trade unit or production unit</th>
<th>Description</th>
<th>Identification</th>
<th>Traceability relationships recorded in the fish farming industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish farm</td>
<td>The site where the fish cages are located</td>
<td>Official permit number received for the Norwegian Directory of Fisheries</td>
<td></td>
</tr>
<tr>
<td>Fish cage</td>
<td>The cage that includes one group of fish</td>
<td>Combination of number of cage and the fish farm permit number</td>
<td></td>
</tr>
<tr>
<td>Fish group</td>
<td>A group of fish that are from the same origin and are treated as a homogenous group. Typically 100,000 to 300,000 fish per group.</td>
<td>Combination of number of fish group and the fish farm permit number</td>
<td>– supplier of fish – fish farm ID – fish cage ID – fish feed supplier – fish feed batch – buyer of fish – wellboat – wellboat trip</td>
</tr>
<tr>
<td>Feed supplier</td>
<td>Company that produces fish feed</td>
<td>Name of feed supplier company</td>
<td></td>
</tr>
<tr>
<td>Feed batch</td>
<td>Unique identification of feed batch. Typically a few tonnes up to 10,000 tonnes.</td>
<td></td>
<td>All fish farms that have bought the specific feed batch</td>
</tr>
<tr>
<td>Wellboat</td>
<td>Boat that transports the fish from fish farm to processing</td>
<td>Name and radio call signal</td>
<td></td>
</tr>
<tr>
<td>Wellboat trip</td>
<td>The specific trip from one fish farm to a processing plant. Typically one fish group or part of one fish group.</td>
<td>Trip number</td>
<td>– fish farm – fish group – processing plant</td>
</tr>
<tr>
<td>Processing site</td>
<td>Site where the fish is slaughtered</td>
<td>Name and address</td>
<td></td>
</tr>
<tr>
<td>Processing batch</td>
<td>All fish groups that are slaughtered at the same time period defined by the processing site. Typically all fish from one fish group slaughtered on one day.</td>
<td>Batch number</td>
<td>– fish farm – fish cage – fish group – wellboat – wellboat trip</td>
</tr>
</tbody>
</table>
most farmed salmon sold to the retailer is traceable back to the breeding stage. This is made possible by using software systems for production and operation control including internal traceability.

Important lessons that have been learned from introducing improved traceability in the fish farming industry are:

- start with easy-to-follow batches (large batch sizes)
- be sure to record essential relationships between batches
- paper files are adequate, but slower to use than electronic files
- it is possible to achieve 100% traceability with only a minimum of information recording
- the food business operators are interested in accessing product properties, like quality parameters and food safety information, from the previous link in the supply chain through electronic systems.

The present traceability challenges for the fish farming industry focus on the implementation of a ‘whole chain’ traceability software system involving multiple food business operators and multiple food supply chains (15).

The implementation readiness of electronic chain traceability systems in the fish farming industry was investigated in 2004–2006 (13). This project identified eight criteria that are important for success:

- presence of chain traceability procedures at point of reception: routines regarding recording of traceability information for all received input factors (not relevant for the first link in a traceability chain);
- use of electronic/automatic data recording technology at reception;
- presence of internal traceability procedures: routines regarding recording of process information and transformation information. The evaluation included all input factors;
- presence of an internal traceability software system;
- use of standard identifiers (ID) on TUs, for example GS1 numbering schemes; serial shipping container code (SSCC), global trade item number (GTIN), or serialised global trade item number (SGTIN) (7);
- use of electronic/automatic data recording technology at dispatch;
- presence of chain traceability procedures at point of dispatch: routines regarding recording of traceability information for all dispatched trade units;
- presence of chain traceability software system: use of electronic exchange of traceability information to customers.

At present these criteria are being evaluated for the meat industry in Norway. This is part of the Norwegian traceability project ‘eSporing’ focusing on establishing a national system for electronic exchange of food traceability information (4).

The principles of traceability (3, 10, 14), and the experiences for implementation in the aquaculture industry (13,15) are regarded as generic for food business operators worldwide. This is supported by the fact that several independent studies have established equivalent principles (4, 6). Thus, the principles may be used as guidelines for establishing sector-specific traceability principles and implementation guidelines for terrestrial food industries. Regarding
ontologies for food safety and animal health information, sector-specific standards should be made for all types of animal husbandry. Both ISO/DIS 12877 (10) and the ‘Can-Trace’ (6) standards may be used as guidelines based on the fact that these standards require both traceability and sector-specific ontologies.

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Experiences in the beef processing industry: traceability in industrial management

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Summary

Traceability is a powerful tool due to its multiple uses. Important benefits range from disease control and support to government public health programmes to all aspects of ensuring product quality for the benefit of consumers. Furthermore, traceability is also a very useful tool for the private industry in process control.

Generally speaking, the main drivers for the use of traceability are food safety and the possibility of reducing the incidence of food-borne diseases.

The decision to start the application of traceability at the first step of the food chain – animal identification and maintenance of proper registration – provides a wide range of options for the application of traceability systems. This situation requires the analysis of a more complex type of information which, although available, needs to be integrated and analysed for the purpose of traceability.

Industry practical experience has shown that traceability is an extremely important management tool since the entire process can be controlled and analysed at every stage through data capture points. These points provide not only effective information for improving production efficiency, but also vital information for controlling potential incidents and so safeguarding public health and consumer confidence.

Keywords: Data capture – Identification – Process control.
Retailer perspectives and experiences

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Summary

This paper will discuss consumer expectations as viewed by retail food businesses with specific regards to various food safety and quality related attributes, including traceability and animal identification.

The reputation and business fate of large retailers and restaurant chains are ultimately reliant upon providing perceived value through products and services provided to consumers. The perceived value of many food products, especially products of animal origin, includes less tangible attributes such as the origin of the product, health of the animal, husbandry practices employed, animal welfare provided, and feed sources utilised just to name a few. For international movement of animals and animal products, harmonisation of national systems is an important objective, and the adoption by countries of international standards (those of the World Organisation for Animal Health (OIE) and the Codex Alimentarius Commission) can help to achieve this goal. While ‘one step forward and one step back’ traceability can often be achieved through routine business documents, animal identification and movement tracking systems are essential if accurate and prompt supply-chain-wide traceability is to occur. Rightly or wrongly, many consumers perceive that complete traceability is essential to ensuring the integrity and safety of food products. These consumer expectations, frequently championed by the retail sector, will continue to drive the adoption and refinement of animal identification and traceability systems.

Keywords: Animal identification and traceability – Consumers – International standards – Retail.
The importance of improved food safety and traceability practices worldwide

C. Smith DeWaal
Center for Science in the Public Interest, United States of America

Summary

Recent foodborne illness outbreaks in diverse food products – both domestic and imported – have raised significant concerns for consumers about the safety of a huge array of foods and the protection offered by national food safety programmes. As global food interdependence increases, maintaining consumer confidence in these systems is paramount. The Center for Science in the Public Interest (CSPI) works to ensure that food safety and other crucial food-related issues are responsive to consumer needs. CSPI recently expanded the Safe Food International programme, a web-based clearinghouse for outbreak reports from around the world to increase transparency about food safety and animal health problems emerging in different world regions. Consumers have expressed support for increased information about the sourcing of their food, including the widespread support for mandatory and comprehensive country-of-origin labelling, animal identification, and farm-to-fork traceability programmes. Improving the information to consumers is crucial in improving their confidence in the global food supply. Consumer interest is high in the ethics of the food supply, issues of humane treatment and slaughter, the environmental impacts of food production, and genetically modified food. Demand for organic, free-range, and locally-grown food has grown, and traceability of animal products is paramount to ensuring the credibility of these labelling schemes. For food products traded internationally, harmonisation of national standards for identification and traceability is an important goal and can be usefully promoted by reference to relevant international standards of the OIE and the Codex Alimentarius Commission.


The Center for Science in the Public Interest (CSPI) is a nonprofit health advocacy and education organisation focused on food safety, nutrition and alcohol issues. CSPI is supported principally by the 900,000 subscribers to its Nutrition Action HealthLetter and by foundation grants. CSPI accepts no government or industry funding. CSPI’s Safe Food International (SFI) project aims to unify and focus the efforts of consumer organisations worldwide that are working to ensure a safer food supply. SFI collects international data on outbreaks and other food safety issues from all regions of the world, and makes the information available by internet and e-mail to member groups and individuals.

Following a series of high-profile food-related outbreaks and recalls, Americans’ confidence in food safety has plummeted. Numerous studies have documented this decline. In a 2009 survey by the University of Minnesota, 78.5% of consumers believed that the food supply is not as safe today as a year earlier (10). In a Consumers Union poll from November 2008, 48% of those questioned said their confidence in the safety of food had declined (3). In July 2008, in the midst of a salmonella outbreak attributed to tomatoes and peppers, a media poll found that 46% of people were worried that they might get sick from eating tainted products (8).

Consumers are concerned for good reasons. Examples of failures in the food system are regularly reported in global media. Outbreaks linked to domestically produced products occur regularly,
and consumers have become greatly concerned about imported products following several tragic and high-profile events. Melamine in dairy products and pet food, salmonella in serrano peppers, and pesticides in dumplings are just a few examples of the many products that crossed international borders and sickened consumers in the importing country. With the globalisation of the world’s food supply, contaminated products can move easily across national and regional borders. Innovations in transportation and refrigeration allow foods to move rapidly so that by the time a problem is discovered, the products may be widely distributed.

Most countries, including developing countries, both import and export food. While there are many benefits from having access to fresh affordable food from all parts of the world, the risks are growing as well. Globalisation of the world’s food supply also increases the risks of intentional contamination (12).

New tools in the area of surveillance have made it much more likely that, at least in the USA, large-scale outbreaks will be identified and traced backed to specific countries or companies. In addition, temporal analysis of outbreak data allows for better identification of the repeat violators that are linked to these events. Traceability is needed to speed the containment of food safety problems and minimise their impact on consumers. Several of these tools are reviewed below.

![Consumer Confidence Tracking](image)

*Figure 1 Consumer confidence tracking*
**PulseNet**

PulseNet is a programme that compiles microbial sub-typing data on several species of bacteria, and maintains a national database for reference and comparison of sub-typing information using pulsed-field gel electrophoresis (PFGE). In the USA, it is coordinated by the Centers for Disease Control and Prevention (CDC), and comprised of a network of state health departments, local health departments, and federal agencies (CDC, the Food Safety and Inspection Service of the Department of Agriculture [FSIS] and the Food and Drug Administration [FDA]). The PulseNet database is used to detect food-borne disease case clusters, to facilitate early identification of common source outbreaks, and to assist epidemiologists in outbreak investigations. PulseNet enables seemingly sporadic cases of food-borne illness to be linked and identified as part of an emerging outbreak (especially when the cases have wide geographic dispersion), allows outbreak-associated food-borne cases to be distinguished from sporadic cases, and can assist in the rapid identification of an outbreak food source.

There are some limitations to the PFGE method and analysis. It is time-consuming, it requires a high level of skill, and it does not work for everything (i.e. PFGE does not work for clonal patterns). Financial limitations and lack of coordination can further limit the effectiveness of PulseNet. Competing priorities and a lack of resources at state, local and federal laboratories can delay submission of lab samples to the PulseNet system (1).

**Outbreak Alert!**

*Outbreak Alert!* is a listing of food-borne illness outbreaks developed and maintained by CSPI. It is the most comprehensive food attribution database in the USA, containing data since 1990. Outbreaks are categorised by food source, and published annually in a report by CSPI's Food Safety Program. The *Outbreak Alert!* data are compiled from the CDC line listing, which contains reports from state health departments. CSPI's database contains only those outbreaks with aetiology and an identified food source. CSPI's analysis shows that outbreaks meeting the criteria of having an identified pathogen and food source represent only about 25%-30% of reported food-borne outbreaks. The large percentage of outbreaks that are reported to CDC with an unknown food or pathogen indicated that many investigations are not thorough enough to answer these important questions. The second important limitation is that sporadic cases of food-borne illnesses are omitted. Thus if only one person reports getting sick, which represents the vast majority of food-borne illnesses, these data are not being captured by this tool. Certain pathogen reporting is largely captured in sporadic reports, especially *campylobacter* and *vibrio vulnificus*, and these pathogens are underreported in the CSPI data (2).

Both PulseNet and *Outbreak Alert!* provide important data on which the USA can identify, investigate and manage food-borne illnesses and food-borne outbreaks, and they are crucial to protect the public’s health. However, these tools to track and connect illnesses and analyse outbreak trends also expose gaps in the systems to track products through a global marketplace. It can take weeks or longer to identify the source of an outbreak.

**Source information**

Recently the USA has adopted a rudimentary tool that can assist in tracing products through country-of origin labelling (COOL). New tools, like a proposed FDA programme for tracking products from ‘farm to fork’, are being considered in Congress. There is widespread public support for these programmes. For example, in the USA, 93% of consumers support COOL, and 80% support more detailed labelling that shows region, country, state and farm of origin (9).
Proceedings of the First OIE Global Conference on Animal Identification and Traceability ‘From Farm to Fork’

Session 5: Private sector perspectives and experiences

The European Union extends traceability through all stages of production, processing and distribution, and requires adequate labelling and documentation. In the European Union, traceability and labelling for the country of origin is required on fruits, vegetables, beef, fish, eggs and wine, as well as for processed foods containing genetically modified ingredients.

Animal identification is a very important programme that is a requirement in Europe to help maintain consumer confidence. It is used around the world to varying degrees in countries such as Argentina, Australia, Brazil, Japan, New Zealand and others. The system in the USA is voluntary, and to date, only 35% of livestock facilities are registered in the system (5).

In addition to knowing that food is safe, consumers have other concerns about the food supply. Consumers want to know that animals raised for human consumption have been treated ethically and humanely, and that food is grown or raised in an environmentally sustainable way.

Ethical and humane treatment

There are a wide range of issues involving the treatment of animals, including hormone treatments, methods used in religious slaughter, and raising livestock in a free-range practice. Standards for the importation of livestock raised on hormones are different depending on the country, which can create confusion. For example, the USA allows hormones in beef and the European Union does not. Additionally, the USA has difficulty exporting poultry because many importing countries have different standards for the use of chlorine in poultry production.

Figure 3 Example of traceback for a salmonella outbreak

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Religious slaughter methods can be controversial among animal welfare groups and religious communities, but the demand for kosher or halal meat is high. Globally, there are 1.4 billion halal-only consumers and 10 million kosher-only consumers, and countries such as Israel and China are increasing their kosher exports (6). In a survey of Americans who purchase kosher food, 55% believed it was safer than non-kosher food; however, the US Department of Agriculture (USDA) has no additional safety requirements for kosher or halal products (4).

Consumers are also showing increased interest in animal husbandry practices, including wanting to know that meat or eggs are produced using ‘free-range’ or ‘cage-free’ practices. But definitions differ both between and within countries. In the USA, the only requirement for free-range livestock is that the animal ‘has been allowed access to the outside’. Australia’s Humane Society tries to avoid ‘free-range’ labelling by instead identifying a product as a ‘Humane Choice’.

**Environmentally sustainable food**

Global consumers are becoming increasingly concerned over the environmental impact of the food they eat, and the demand for organic food is rising all over the world. In several consumer surveys, 75.6% of Chinese, 34.2% of Japanese (11), and 33% of Thai consumers (7) said they buy organic food. Additionally, consumers are seeking food that has been locally grown. In the USA, shoppers at farmers’ markets are willing to pay twice the amount that retail grocery shoppers pay for the same locally produced food. Americans tend to favour buying food produced by small farms over what they perceive as corporate operations.

In an increasingly globalised world in which food is imported and exported by nearly every country, the information available to identify and trace the origin of food needs to be improved. In order to do this, harmonisation of international standards for traceability, animal identification, and imported food is urgently needed. Countries that do not have animal tracing systems in place may find that their producers’ access to world markets is compromised, as consumers and branded companies will be less willing to purchase products that are not traceable.

The author would like to acknowledge Jacqlyn Witmer and Sarah Klein as contributors to the research and preparation of this article.

**References**


Session 6

Capacity building to assist implementation of standards worldwide

Chair: Dr François Le Gall
President of the Advisory Committee of the
OIE World Animal Health and Welfare Fund, World Bank

Objectives: to introduce capacity building and communication activities supporting implementation of the international standards
Developing country expectations

I. Daré
West African Economic and Monetary Union (UEMOA), Burkina Faso

Summary

The increasingly restrictive rules governing international trade are imposing drastic reforms in the areas of food safety and human and animal health protection. These rules include the ability to trace the progress of a foodstuff from primary producer to final consumer. Animal identification and the traceability of animal products are key to this process.

Insufficient human, financial and material resources make it difficult for developing countries, especially those in Africa, to update their regulations to comply with these rules.

Furthermore, in Africa in particular, livestock production systems are mainly of the traditional extensive type, based on highly fragmented production methods and extremely mobile herds, making it complex and costly to implement the required measures for animal identification and the traceability of animal products.

For instance, in some countries of the Sahel, as many as 90% of ruminants are herded in national and cross-border transhumance spanning hundreds of kilometres. The major problem posed by transhumance is the epidemiological risk that it represents and the difficulty in monitoring the progress of herds. For this reason, all the national regulations and bilateral and community agreements of the countries concerned make it compulsory for transhumant livestock producers to carry an international transhumance certificate (CIT). The certificate is designed to facilitate the control of herd movements, and contains essential information on the composition of herds (identification of animals by species, sex, age, etc.), all vaccinations administered, the route to be taken by the livestock, the border posts through which the livestock must travel, and their final destination.

The certificate is therefore an essential tool for animal identification and traceability. However, it is being used less and less frequently owing to lack of resources, including for monitoring and evaluation of its impact.

Similarly, apart from in slaughterhouses in large urban centres and modern animal product distribution channels, the traceability of these products remains haphazard.

In a bid to redress this situation, many countries and a number of Regional Economic Communities (REC) have initiated discussions to consider the need to establish systems for the identification and traceability of animals and animal products, based on international standards, particularly those of the World Organisation for Animal Health (OIE) and Codex Alimentarius Commission.

In recognition of the need to detect and report epidemiological events, investments in identification and traceability systems should be considered a public good. The international community, especially the OIE, must support this effort, which must necessarily be gradual and should lead to the design of systems best suited to national and regional contexts.
This support should be undertaken via medium- and long-term commitments and should focus on the following actions:

1. To conduct feasibility studies:
   - evaluation of production, processing and distribution systems for each country or homogeneous geographic area
   - identification of the principles to be adopted and the tools to be used for identification and traceability
   - definition of the objectives of the system to be set in place (aims and purposes) and specification of the tool
   - determination of the scope and extent of use of the identification and traceability system (principle of proportionality to the needs identified, cost/benefit, links with other systems (zoning, compartmentalisation, inspection and certification, etc.));

2. To define an appropriate legal and administrative framework:
   - proposal for an institutional and legal platform for managing the system, the procedures to be followed, the public/private partnership, etc.;

3. To establish an implementation programme:
   - for the field of application defined, including the possibility of initiating pilot actions.

Figure 1 shows an international transhumance certificate (CIT).
Session 6: Capacity building to assist implementation of standards worldwide

Figure 1 An international transhumance certificate (ITC)
Summary

The objective of this presentation is to explain the various activities and programmes that the World Organisation for Animal Health (OIE) carries out to support its Members (especially the least developed countries) in the proper implementation of international standards, including those relating to animal identification and traceability, all of which bring benefits to OIE Members.

At present the OIE has 172 Member Countries and Territories, two-thirds of which are developing countries or countries in transition.

For the OIE to achieve the objective within its broad mandate ‘to improve the health and the welfare of animals all over the world’, many OIE Members need technical, financial or structural support to enable them to comply with OIE standards and play an active part in the OIE standard-setting process. Through its collaboration with experts globally and with partners, including international donor organisations, the OIE can help to provide the help that Members request.

Keywords: Gap analysis – OIE focal points – OIE PVS Tool – OIE standards – Veterinary Services – World Organization for Animal Health.

In order to maintain close contacts with its Members and to understand their problems and needs, the OIE has set up permanent Regional or Subregional Representations in Bamako, Mali; Gaborone, Botswana; Tokyo, Japan; Bangkok, Thailand; Buenos Aires, Argentina; Panama City, Panama; Sofia, Bulgaria; Brussels, Belgium; Beirut, Lebanon and Tunis, Tunisia.

Under the coordination of OIE Headquarters, each of these Representations draws up an annual programme of activities aimed at building capacity for harmonising animal health policies worldwide, including traceability, making the necessary adaptations to the specific conditions of each region. In the main, these work programmes comprise capacity-building activities in support of national Veterinary Services.

The OIE World Animal Health and Welfare Fund, which is financed by a number of international donors, has as its major objective the support of these capacity-building activities, by means of global programmes and specific activities in each region in line with regional priorities. The Fund finances projects of international public utility relating to the control of animal diseases, including those affecting humans, and the promotion of animal welfare and animal production food safety. The Fund also promotes appropriate mechanisms for the governance of veterinary health policies worldwide in line with the OIE’s international quality standards for the performance of Veterinary Services.

As the world lead agency for animal health, the OIE participates in various platforms and forums where mechanisms and strategies for the control and eradication of animal diseases, including those transmissible to humans are developed. These mechanisms usually include tools, methods and procedures to support countries that request assistance.
As the OIE considers Veterinary Services to be a Global Public Good, it is currently implementing a range of programmes and projects to build the capacity of Veterinary Services. The OIE offers its Members the use of the OIE PVS Tool for the voluntary evaluation of the performance of their Veterinary Services in order to assess their level of compliance with OIE quality standards. Based on the results of this evaluation, a gap analysis process is conducted to prepare investment projects in line with the priorities set by the Member concerned. The OIE then lobbies key international donors to provide financing for these projects.

Further OIE strategies for the benefit of its Members include:

- a twinning initiative with OIE Reference Laboratories and Collaborating Centres, aimed primarily at ensuring the more uniform world distribution of available expertise in support of OIE Members in animal disease control and to increase their participation in international standard-setting processes;
- a general model of veterinary legislation that the OIE has developed to assist its Members in updating and modernising their legislation to meet OIE standards, particularly developing countries where health legislation may be obsolete;
- continuing training of OIE Delegates and their key staff (mainly OIE focal points for various issues) to ensure that they are aware of their rights and obligations and are able to carry out their duties relating to OIE standards in a more effective manner. There is a high turnover rate among OIE Delegates, especially in developing countries, of more than 30% per year. This training includes regional workshops (or national workshops in specific cases) and seminars on subjects that can be either specific or generic, such as the Good Governance of Veterinary Services;
- establishment of Regional Animal Health Centres in connection with the OIE/Food and Agriculture Organization of the United Nations (FAO) Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs) Agreement, to provide technical assistance to countries for the control of animal diseases;
- implementation and monitoring of specific projects (such as World Trade Organization (WTO) Standards and Trade Development Facility projects) to support building the sanitary and phytosanitary standards (SPS) capacities of Members;
- implementation and monitoring of specific projects for the implementation of OIE international standards, such as for the compartmentalisation of certain diseases.

**Conclusions**

The OIE will pursue its policy of supporting its Members in the implementation of international standards, an aspect that will be clearly reflected in its Fifth Strategic Plan, with continued capacity-building and support for its Regional and Subregional Representations to enable them to provide close and continuous assistance to Members.

The implementation of OIE standards on traceability will be included in OIE training programmes for Delegates and Focal Points of Members.
Capacity building in support of animal identification for recording and traceability: FAO's multipurpose and global approach

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Summary
In recent years, the main forces driving the development of traceability systems for animals and their products have been concerns about animal and human health. As a response, animal identification and traceability have been addressed by various international agreements and standards, such as the World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures, the World Organisation for Animal Health (OIE) Terrestrial Animal Health Code and the Codex Alimentarius under the Joint Food Standards Programme of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). Other organisations such as the International Committee for Animal Recording (ICAR) and the International Organization for Standardization (ISO) also play a relevant role.

Animal identification is not only an essential component of traceability and disease control, it also serves multiple other purposes in a country’s livestock sector. The unique identification of animals is the basis for pedigree and performance recording, artificial insemination schemes, subsidy payment schemes, good farm management, prevention of animal rustling and trade certification, and contributes to securing access to markets for higher-quality and geographically identifiable products.

While the role of national competent authorities is fully recognised, the multipurpose implications of animal identification systems need to be considered and discussed with all relevant stakeholders, to increase their acceptance and the equitable distribution of the costs among all stakeholders.

Capacity building is needed to enable standards and schemes to be applied adequately; this is at the heart of FAO’s mandate. Taking account of the multipurpose nature of animal identification, FAO’s capacity-building activities rely on an integrated approach that involves all relevant partners and stakeholders. FAO provides support for relevant policy development, drafting of legislation and strategic planning, and technical assistance for the implementation of relevant Codex Alimentarius and OIE standards. FAO’s collaboration with ICAR on animal recording for smallholders in developing countries dates back to the 1990s. Decision-support guidelines for establishing sustainable animal identification and recording systems are currently being developed. FAO facilitates access to knowledge, information, training tools and services that are relevant to animal identification for traceability and performance recording. Effective capacity building requires alliances among organisations, based on a shared understanding of goals, coordination and acceptance of the complementary roles of the different players.

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Animal identification for recording (I&R) has a key role to play in addressing global demands for food security and poverty alleviation. Animal I&R has many uses. It is necessary for better farm management, theft control, maintenance of herd books, delivery of health certificates, and for implementing agricultural policies (such as subsidies). It is fundamental to the establishment and maintenance of breed improvement programmes.

The growing socio-economic importance of livestock, and trends in livestock production, directly or indirectly influence the development and organisation of animal I&R and traceability programmes. Increasing demand for foods of animal origin has favoured the intensification of animal production and the emergence of an industrial private sector for dairy, pig and poultry production in many developing countries and countries with economies in transition. The forces driving this so-called livestock revolution are not only shifting the location of consumption and production, they are also affecting the way in which livestock products are produced and marketed. The process involves globalisation of animal production and trade in animals and animal products, as transportation costs and tariff barriers are reduced. Related trends include the increasing scale of operations, and the geographic concentration and vertical integration of production systems, all of which are leading to longer food chains.

In recent decades, developing countries have overtaken developed countries in total production of meat and eggs, while the gap in milk production is rapidly narrowing. Monogastric production is increasing relative to ruminant production. Worldwide, animal production is moving closer to the sources of feed – either to feed-producing countries or close to ports. At the same time, animal production and animal product consumption has moved also from rural to urban and periurban areas. There is also growing awareness among consumers about food safety, quality, animal welfare and the environmental impact of livestock production.

There is now increasing interest worldwide in animal I&R and traceability systems, including in developing countries and countries with economies in transition. The main driving force for implementing traceability systems is the protection of human health and food safety. Past food and health scares such as those caused by bovine spongiform encephalopathy (BSE), avian influenza and several chemical contaminations (dioxin, melamine, etc.) have increased concerns about veterinary public health, food safety and the need to trace products from ‘farm to fork’. Since the beginning of the 1990s, animal identification and traceability systems have been used mainly to protect human health through i) identification of animals and tracing and controlling their movements, ii) identification, tracing and recalling of contaminated foods (and feeds) at any stage of the food production and distribution chain, and iii) risk management.

A second aspect of traceability is ensuring fair practices in the food trade, as traceability provides protection against deceptive practices and fraud in the market place and unsubstantiated product claims (e.g. geographic indication or food quality). Awareness among consumers about food safety, quality, animal welfare and environmental impact of livestock production, and consumers’ demand to be better informed, have also pushed the competent authorities and private sector towards traceability of animals and their products. Private standards stand alongside the international ones.

Animal I&R and traceability are addressed by various international agreements and standards, such as the WTO Agreement on the Application of Sanitary and Phytosanitary Measures and
its Agreement on Technical Barriers to Trade, the OIE Terrestrial Animal Health Code and the Codex Alimentarius under the Joint FAO/WHO Food Standards Programme. Other organisations such as ICAR and various private stakeholders also play a role. International standards are set by standard-setting bodies, private standards by large corporations. In most cases, compliance with standards is certified by an independent body such as the ISO.

At national level, governments are responsible for incorporating international standards into national legislation, while other competent authorities (e.g. ministries of agriculture and livestock, Veterinary Services, ministries of health and national bureaux of standards) ensure that legislation is applied and enforced. Audit and certification bodies should then certify compliance with legislation or standards. Finally, breeders’ organisations and the livestock and food industry are also relevant players at national level. While the role of national competent authorities is fully recognised, the multipurpose implications of animal identification, recording and traceability systems need to be considered and discussed with all relevant stakeholders, to increase their acceptance and the equitable distribution of the costs among them.

Capacity building is at the heart of FAO’s mandate, including to enable countries to adequately apply standards and schemes. Taking account of the multipurpose nature of animal identification and traceability, FAO’s capacity-building activities rely on an integrated approach that involves all relevant partners and stakeholders.

FAO’s Technical Cooperation Programme (TCP) was established in 1976 to assist member countries to address their priorities (more information is available at: www.fao.org/tc/tcp, accessed on 15 June 2009).

Such programmes supported the drafting of animal identification and recording legislation, and the design of national identification systems, in several countries including Chile, Lesotho, Malawi, Nepal, Uganda and Ukraine. Animal identification and traceability have been components of technical cooperation projects in the fields of veterinary public health and food safety and quality (e.g. prevention and control of BSE and other zoonoses). The Programme on Food Quality Linked to Geographical Origin and Traditions has included regional seminars (Chile, Morocco, Serbia and Thailand), technical cooperation projects (Bhutan, Morocco, Tunisia and the Latin America and the Caribbean region), ten case studies in Latin America and six in Asia. A guide on how to establish specific quality schemes linked to geographical origin is in preparation, as is a regional project in the Mediterranean.


In 1998, FAO developed the first guidelines on animal recording for medium-input production environments (1). Currently, decision-support guidelines for setting up sustainable animal
identification and recording systems are being developed in collaboration with the ICAR Task Force for developing countries, which is chaired by an FAO officer. These guidelines are based on existing standards and guidelines, and draw on lessons learned from current and past experiences.

The Task Force is conducting a survey on the current state of animal identification and recording programmes in Africa, Asia, Central and Eastern Europe, and Latin America. So far, 38 countries have answered the questionnaire. The preliminary results show no regional specificity. Animal identification systems and their implementation vary widely from country to country. Different animal I&R systems addressing different needs coexist and are run by different institutions, which generally do not communicate with each other. Many of these programmes have failed, particularly those targeted at low- to medium-input systems. The survey shows that the motivation for setting up animal I&R programmes varies widely among countries and among programmes within the same country. In some countries (e.g. Argentina and Uruguay), the requirements of lucrative export markets such as the European Union (EU) have prompted the establishment of mandatory and/or voluntary identification and traceability systems. Countries in Central and Eastern Europe that have lately joined the European Union (e.g. Hungary and Slovakia) reported that ‘they have been obliged to comply with EU regulations’. In many countries (e.g. Kenya and South Africa), breed societies have spearheaded identification and pedigree recording programmes since the early twentieth century. Such programmes are characterised by voluntary nationwide participation of breeders, and are aimed at perpetuating breed purity. Pedigree recording has subsequently been merged with performance and conformation recording for the purpose of genetic improvement. Control of diseases by monitoring the movement of animals is the main purpose of animal identification and recording in countries such as Malaysia and Thailand; these are mandatory national programmes.

The FAO has included animal identification and traceability considerations among its activities in support of the implementation of Codex Alimentarius standards and guidelines, such as the manuals and training workshops related to the Codex Alimentarius Code of Hygienic Practice for Meat, Code of Hygienic Practice for Milk and Milk Products and Code of Practice on Good Animal Feeding. One example is the FAO manual of Good practices for the meat industry (2). More information on all the above is available on the website of FAO’s Animal Production and Heath Division: www.fao.org/ag/aga/html (accessed on 15 June 2009).

The Joint FAO/International Atomic Energy Agency programme on nuclear techniques in food and agriculture also addresses animal identification and traceability through technical cooperation programmes, research networks, coordinated research projects, and agriculture and biotechnology laboratory training courses. More information is available at: www-naweb.iaea.org/nafa/index.html (accessed on 15 June 2009).

Finally, the FAO Legal Office, in close collaboration with its technical services (for instance the Animal Production and Animal Health Services) provides relevant assistance to member countries wishing to develop or upgrade specific legislation addressing animal identification and traceability, and gathers information on existing legislation worldwide in its database FAOLEX (4). Relevant information on existing legislation is also available via the International Portal on Food Safety, Animal and Plant Health (12).

Lessons on implementing animal I&R programmes in developing countries and countries with economies in transition can be drawn from past and present experiences. Failure to implement sustainable I&R programmes in these countries has mainly resulted from a combined lack of financial resources, lack of capacity in implementing institutions and lack of participation by breeders or other stakeholders. The high costs of infrastructure
for animal I&R systems (e.g. computer hardware and software, equipment and transport) and operational expenses (e.g. ear tags and field staff travel) have been insurmountable hurdles for many developing countries. Governments have generally failed to commit adequate resources to I&R programmes because of a lack of awareness of their importance. Government financial support, particularly at the implementation stage, is vital to the success of national I&R programmes. The flow of benefits from animal identification, recording and traceability to the different stakeholders in the value chain must relate to the costs that are incurred at each level. In the case of voluntary I&R programmes, poor adoption by farmers is one of the main reasons for failure. Farmers may feel that their privacy is being intruded upon and that the confidentiality of their information is not being respected, and may therefore not participate.

These lessons present a sound basis for identifying the requirements for sustainable animal I&R systems. Enabling policy and legislative frameworks are necessary. Adequate governmental support, both technical and financial, is another prerequisite. An I&R system should be run efficiently and professionally, be matched to the available infrastructure, and take relevant cultural and traditional factors into consideration. It should operate at a low cost and be no more complex than is necessary to ensure its accuracy and integrity. Its implementation should be phased, and implementing institutions should ensure that they have adequate capacity before they embark on the programme. Specialist skills in areas such as information technology, animal identification, recording and technology transfer are vital to its success. Farmers and livestock keepers will participate in the programme only if it demonstrates real and direct benefits to them. It is therefore important that the implementing institutions develop systems that provide feedback and demonstrate the direct benefits. This may be achieved by streamlining I&R systems serving different purposes and incorporating them into a service package.

References


The Inter-American Development Bank and its financing of animal identification and traceability programmes

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Summary
Since its creation in 1959, the Inter-American Development Bank (IDB) has been heavily involved in financing the national programmes of its Member Countries to strengthen and develop their national animal and plant health services. It has also used donor funding for technical cooperation projects to help build institutional capacity to implement major plant and animal health campaigns, especially for the control of foot and mouth disease.

In connection with plant and animal health and food safety programmes and projects, the IDB finances activities to support compliance with the World Trade Organization (WTO) international agreement on the application of sanitary and phytosanitary measures (SPS Agreement), which includes animal identification and traceability measures, in compliance with Codex Alimentarius Commission and World Organisation for Animal Health (OIE) standards.

The IDB and OIE signed a memorandum of understanding in 2008 designed to help OIE Members’ Veterinary Services to improve their capacities and to support and promote animal health. This cooperation agreement has defined a number of important areas:

Promoting support for building the capacity of Veterinary Services.

- participating in activities to control animal diseases and improve the safety of food of animal origin
- promoting and encouraging the use of international standards of quality by the OIE’s Veterinary Services.

The OIE PVS Tool for the evaluation of performance of Veterinary Services (OIE PVS Tool) provides for a qualitative assessment to identify needs with the objective of building Veterinary Services’ capacities to meet the OIE standards for quality (Chapters 3.1 and 3.2. of the OIE Terrestrial Animal Health Code 2008). The PVS process involves the initial country PVS evaluation by groups of independent experts trained by the OIE to identify any shortcomings in national Veterinary Services. This may be followed by a PVS gap analysis, which provides for a quantification of needs and an indication of the corresponding budget to address compliance for priority critical competencies. Corresponding investment projects can then be developed with the potential for funding from IDB credit lines.

The IDB has a wide range of financial instruments to support the development of public-sector plant and animal health programmes and projects: investment loans; policy loans; conditional credit lines for investment projects; performance-driven loans and technical cooperation projects. The IDB also has financial instruments to support private-sector initiatives. In this connection, it has focused special attention on financing programmes for the purposes of:

- market opening and integration into the international economy
- modernising production services, which includes strengthening market information systems, export promotion, plant and animal health, food safety and quality certification for plant and animal products
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- supporting the implementation of trade agreements on plant and animal health, including the adoption of international standards on food safety and traceability, in compliance with Codex Alimentarius Commission and OIE standards.

Keywords: Codex standards – Identification and traceability – OIE PVS Tool – OIE standards – World Organisation for Animal Health.
Session 7

Future needs in standard setting and research

Chair: Dr Carlos A. Correa Messuti
Vice-President OIE Administrative Commission, Delegate for Uruguay

Objectives:

– Establish future needs for standards
– Present an overview of the technologies under development or in the testing phase
– Address the challenges related to identification and traceability of biotechnology-derived animals
Links between traceability systems and animal health management

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Summary
The objective of this paper is to demonstrate the vital linkages between the animal health information management system and animal traceability. This information system is not only used in establishing the zoo-sanitary status of the country but also for the prophylactic approach and to manage any crisis situation. All the farms and the bovine animals are identified through physical identification and documentary evidence with the details contained in a national database. This database allows the authorised operator to edit documents, develop analytical plans and transmit the information electronically to laboratories (including bar-codes for identification). The laboratory results can then be sent through electronic data interchange (EDI) without any fear of error. Through the national database, the national authority can correlate the laboratory results with the particular animal and this can help to trace all the farms where the animal was kept, as well as the animals with which it came into contact. In an emergency situation, this allows the national authority to identify a perimeter relevant to the index farm. The adjacent farms of interest can be mapped and documented to facilitate rapid response in terms of organising veterinary inspections and implementing administrative and biosecurity measures. In addition, by collecting mortality data, it is possible to institute a permanent surveillance system using epidemiological curves. After an initial period of establishment, this information system has been shown to be a robust and powerful tool that can readily support additional activities. The information system is user-friendly, it reduces the need to recapture data, facilitates work and is a secure means of transmitting laboratory data through bar coded information. Use of this information system greatly facilitates the implementation of systems for cattle identification and product traceability consistent with OIE standards.

Keywords: Animal health management – Annual prevention campaigns – Database – Identification – Information system – Laboratory results – Livestock production – Traceability.

The Fédération Européenne pour la Santé Animale et la Sécurité Sanitaire (FESASS) is the European federation for animal health and sanitary security. One of its members is the French national livestock producers’ federation for animal health (Fédération Nationale des Groupements de Défense Sanitaire, FNGDS). Livestock producers play a key role in the national organisation of animal health, which relies on a tripartite structure of livestock producers (via their animal health association), private veterinarians and the Veterinary Services. FESASS wishes to build the same structure on a European scale.

The links between traceability and animal health are illustrated by France’s national information system. This information system is managed by the national Veterinary Services, jointly with FNGDS, at both national and local levels.
This information system requires a few hours of work by users, in order to meet a number of goals:

- the locally input data can be used immediately by the central authority. All users enter the data of concern to them (on cattle, identification, traceability, animal health results, classifications and inspections). This makes it very easy to ascertain the country’s animal health status, to create reports in accordance with requirements, to transmit assessments (to the European Union, for instance), to retrieve lists of approved establishments, and so on. Inputting data locally means that all the elements for traceability are collected at the very first level (declaration by the livestock producer), before being transmitted along the entire information chain up to the national level;
- the veterinary authority is able to consult the epidemiological and administrative information and take the relevant decisions based upon it;
- this information system can also be used to transmit national requirements to the devolved services: for example, the number of samples to be collected and the analyses to be conducted;
- such exchanges of data call for extensive preparation in order to adopt a common language. This requires the construction of a single reference framework, but that is not all. As many different methods are to be shared, a series of discussions are required, but the result is highly satisfactory. One highly positive impact is that it improves the methodologies of the Veterinary Services as a whole;
- users also need to exchange data with other users, and this information can be shared. In addition, the central authority has a system for distributing access rights, which enables it to choose which user categories will be given access to each type of information;
- this facilitates the preparation of information for transmission to international organisations.

The links between traceability and animal health can be illustrated using the example of cattle identification (including traceability), and its links with prevention.

France’s national identification database for cattle (Base de Données Nationale d’Identification, BDNI) lists all cattle herds, each identified by a reference number. Every bovine animal within the herd is also identified by a unique number marked on two identical ear tags. This number remains the same throughout the animal’s lifetime, irrespective of its economic purpose, the number of movements and even if it loses one of its ear tags.

The livestock producer is responsible for notifying all the animal’s movements (including birth, sale, purchase, boarding, transhumance, slaughter and death). All this information is recorded in the national database, and there are a number of procedures for tracking down anomalies in order to rectify any errors as early as possible.

This identification database is permanently connected to the national animal health database.

France’s national animal health database has been in operation for nine years. The user licence has been distributed to a total of 5,000 departmental veterinary service directorates (DDSV) and departmental farmers’ animal health associations (GDS). A total of 800 officials can use it simultaneously.

- the database is intended to progressively cover all the needs of both local and central administration veterinary services, as well as the needs of the national livestock producers’
federation for animal health, which is a member of FESASS in the fields of animal health, food safety and environmental protection. The database also meets administrative needs (management of officials and directives);

- these needs are divided into 28 ‘reference programmes’. Each of the programmes progresses at its own pace, and individual users can confine their use to the programmes that they select;

- it is possible to imagine replicating the system in other countries.

**Traceability of animal health samples**

This paper concerns the animal health surveillance of cows, and the links with laboratory results.

At the outset, it is the bovine animal that is of interest. The animal wears two ear tags bearing its reference identification number. The number is entered into the animal health database. This enables the veterinary services to link the animal’s number with any analyses to be conducted for annual prevention campaigns, such as for infectious bovine rhinotracheitis (IBR) and brucellosis.

The database system then produces an accompanying document, which is sent to the veterinarian for dispatch to the laboratory together with the samples. In the accompanying document there is one line for each cow, with its number, and for each cow, the analyses to be conducted are listed. The document also contains a label for each cow, always with the same number, together with a few supplementary items of information, on a barcode. The veterinarian sticks the label to the blood tube and sends the tubes to the approved laboratory together with the accompanying documents.

Meanwhile, the laboratory will have received an electronic file from the database containing the computerised laboratory requisition. This file corresponds to the paper-based accompanying document and includes all the cows and, for each cow, the list of analyses to be conducted are listed. The laboratory then reads the barcode on the label automatically, which allows it to identify immediately the bovine animal to which the blood sample belongs, as well as the requisitioned analyses.

In parallel, an entire system has been constructed of computerised exchanges with the laboratories. This system is based on a data interchange format called SACHA (after the French acronym for animal health, chemistry and food hygiene), which is open to any interested party for dispatch to any interested laboratory. The system gives all the necessary instructions for electronic data interchange (EDI). EDI refers to the structured transmission of data between computer systems according to standard technical rules.

After defining this format in advance, all the laboratory needs to do is to send its result electronically to the national animal health database.

The SACHA website describes the operation of this open data interchange format: www.edi-sacha.eu. Each requisitioner may then define their own specific operating procedures and share them with the linked laboratories.

**Relations between identification and animal health results: information provided by the database**

Database users can consult the laboratory results whenever they wish. The results are pre-sorted by geographical area and by date to enable users to retrieve those that have already been processed.
The user then chooses the programme of interest (such as cattle disease prevention), and starts by ascertaining the number of results received. Each result corresponds to an establishment, and contains the same number of blood samples as there are bovine animals sampled.

The first information is colour-coded by type of result: if the result is ‘green’, it means that the results are fine and the user need take no further action. However, if the result is red, there is cause for alarm: it is an animal health alert. The user is then given access to further details about the results.

The next item of information is the analysis plan for which the alert was given. This states whether the positive result is for brucellosis, which would jeopardise the country’s status as an officially brucellosis-free country. If the result is for IBR, although the country’s disease status is not jeopardised, supplementary information now needs to be collected.

Using very simple procedures, the user can rapidly collect a variety of information:

- the identification of the positive bovine animal;
- the animal’s history: identification of each establishment through which the animal has passed. This makes it possible to assess the risk factors associated with the animal’s movements;
- the animal health status of its host establishments, especially for the disease that has given rise to the health alert;
- the other positive bovine animals in the same herd. The same search can be conducted for each bovine animal;
- the positive bovine animal’s other health results, especially concerning the disease in question, in order to trace the history of its animal health results;
- the products from this bovine animal. The same research can be conducted for each of its calves;
- explanations about the positive result: the type of sample, use of mixed sample analyses, the number of lines of analysis, the type of kit used for the test, and the interim results for each phase.

Optimum use is made of the animal health data as the identification and traceability information makes it easy to browse all the events associated with the animal in question.

**In an emergency**

All the maps of France’s national territory have been entered into the database (at 1:25,000 scale). Any point with a geographical coordinate can therefore be identified on this map. This is done with establishments, in particular, and is used whenever there is an outbreak of a contagious disease. The outbreak is then marked on the map. Based on a reference point, the application makes it possible to draw a zone around the outbreak with the radius stipulated in the current regulations. This zone can be adapted to suit the real conditions on the ground, including graphically.

The other establishments located within the zone that are concerned by the contagious disease can then not only be pinpointed on the map, but can also be assigned a reference point in the database. This makes it possible to reuse the information at leisure, to inform private veterinarians authorised to perform specified animal health activities (vétérinaires sanitaires), organise inspections, send out correspondence, monitor the results or introduce biosecurity measures.
**Ongoing surveillance of France’s national territory**

All the individual cattle data relating to carcass disposal are entered into the database. One of the aims is to establish ongoing animal health surveillance nationwide, in particular by using epidemic graphs. Every year a graph is drawn for the monthly distribution of the tonnage of bovine carcasses. Although the graphs normally tend to be very similar, the heatwave in late summer of 2003 is apparent in the graph in Figure 1. Could cattle deaths serve as a warning to anticipate the risk of human deaths?

![Figure 1 Monthly distribution of the tonnage of bovine carcasses](image)

The DGAL and FESASS are satisfied with this information system. Although it must undergo continuous improvement, it is already an effective instrument.

Traceability is one of the areas where an information system can be very useful. Taking the example of cattle identification and disease prevention, the animal’s complete number is entered into the information system only once, when the animal is identified for the first time, and thereafter it is never entered manually but is always transmitted electronically. This removes all risk of human error being introduced to disrupt the information chain.

The identification efforts invested in the information system are well worthwhile because they allow the animal health results to be linked with the automated acknowledgement of the related bovine blood sample. Similarly, the benefits of the laboratories’ efforts in signing up to the EDI system are reaped in any animal health alert, when it becomes possible to retrace the full history of the bovine animal concerned and its contacts.

This involvement by the competent authority, the unique and long-term national identification of each establishment, and the individual identification of each bovine animal, taking every precaution to ensure that it remains the same for the animal’s entire lifetime whatever events may occur (from a change of owner, to moving from an establishment, to loss of the ear tags), are all intended to comply with the identification and traceability standards laid down by the World Organisation for Animal Health (OIE) in its *Terrestrial Animal Health Code* (1), in particular Chapter 4.1, Article 8.
Traceability therefore becomes a quality criterion of the work performed, and especially the quality of the data used. It is the first criterion for improving the information system.

Other criteria for improving the system include:

– performance: speed of use, availability of the necessary functions, simultaneous display on the screen of the fields to be linked, and so on;

– enhancing the ability of new programmes to handle as much of the users’ work as possible. Shortly it is intended to introduce a new programme for managing avian salmonellosis, in the interests not only of animal health but, most importantly, of public health.

The information system is playing an increasingly important role in animal health management, and is patently proving useful.

However, the system was not built in a day. It took a lot of energy, extensive discussions and the commitment of the main project leader. Many questions were raised, some of which were resolved by discussion, while others required a number of attempts before the ideal solution was found. And much work remains to be done, which will be carried out according to the same protocol.

Some countries have had similar experiences to those of France, and they have many solutions to put forward. Other countries are about to embark on this journey, and may wish to benefit from the advances made by other countries, adapting them to suit their specific local requirements.

As it is costly to build an information system in terms of both time and money, it is hoped that this investment can be pooled. The DGAL and FESASS propose to share these experiences with all interested countries.

Reference

Information management – traceability system

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Summary

The implementation of a traceability system requires the entry or collection of a large amount of data, the nature of which depends on the objectives, scopes and desired outcomes of the system. As described in the World Organisation for Animal Health (OIE) standards, these should be defined clearly through consultation between the Veterinary Authority, relevant sectors and other interested parties. In designing the system, preliminary studies on information management are recommended to determine how the data should be collected, validated and processed, how long they should be kept, and what kind of security measures should be implemented. Depending on legal framework, accessibility to data may also vary from one country to another.

The success of a traceability system hinges on the commitment of all links in the food continuum. The benefits of each party should be maximised whereas the workloads and costs should be minimised.

Practical examples of information management within a traceability system introduced in 2002 were presented for discussion at the conference.

Keywords: Access to information – Data security – Information management – Traceability – World Organisation for Animal Health (OIE) standards.
Identification and traceability of biotechnology-derived animals: current options in food animal traceability

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Summary
Reliable animal identification methods are critical to the success of tracking systems, whether used for genealogical, animal health and food safety traceback or for market-based applications. Given the variety of reproductive technologies and modes of genetic transmission possible, tracking of biotechnology-derived animals and their descendants can pose special challenges. An associated dilemma is how to differentiate genetically modified animals from those derived using traditional breeding methods, or those derived through assisted reproductive techniques, including Somatic Cell Nuclear Transfer (SCNT)-derived clones. The capacity for tracking and reliable traceback of animals generally relies on having a unique positive animal identification and verification against a central database. Various animal identification options are possible, though not all may be sufficient for biotechnology-derived animals, including SCNT-clones. Physical tagging and marking, deoxyribose nucleic acid (DNA)-based identification, radio-frequency identification (RFID) and retinal imaging are a few of the identification methods that can be used as part of a tracking system. In the case of animal clones, retinal imaging has been shown promise in this area. Regardless of which method is chosen, complications are sure to arise in the form of technical difficulties and associated expenses, to name a few. It is possible that a combination of molecular (e.g. DNA) together with another physical identification method may be required. The information stored in a centralised database could be made available as appropriate to various parts of the food and feed chain through means such as the internet. In all cases, consideration will need to be given to the possibility of tampering. Nevertheless, animal identification and capacity for successful traceability have in many countries become a requirement of the food, animal, and public health systems in order to protect public and animal health and allow consumers to have a better and informed choice. The World Organisation for Animal Health (OIE) and Codex Alimentarius standards provide a baseline for identification and traceability systems for animals and their products. However, consideration should be given to developing additional recommendations on the methods that are most appropriate for use in the identification and tracing biotechnology-derived animals and their products.

Keywords: Biotechnology-derived animals – Codex standards – DNA-based molecular technologies – Genetically modified animals – World Organisation for Animal Health (OIE) standards.

Traceability could be defined as ‘the ability to trace and follow food, feed, food-producing animals or substances intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution’ (2), or ‘the ability to follow an animal or group of animals during all stages of its life’ (32). Traditionally, traceability systems have been developed on a sector-by-sector basis. There are three main pillars to
Traceability systems: the identification of animals or products, the ability to follow their movement, and the identification of departure and destination premises.

Animal identification in many forms, including but not limited to brands (hot iron and freeze), ear notches, paint marks, tattoos, tail tags and ear tags, has been used for years for the purpose of asserting ownership, record keeping, or as mandated by animal control regulations. Although these methods have been sufficient for recognising animals from different farms, their usefulness follows the life of animals and may not be helpful in tracing the products back to their farms of origin after the animals are slaughtered, particularly under large-scale distribution systems. Most of these traditional identification methods, particularly those using temporary tags, are not an unalterable form of identification that can be used on a national and international scale for effective tracing of livestock animals if they are not complemented with a comprehensive database system.

The occurrences of foot and mouth disease (FMD) and bovine spongiform encephalopathy (BSE) in the early years of the twenty-first century in particular mean that the public's awareness of the origin of their food has increased, and so too has their demand to have an animal tracing system that is both sound and reliable. In order to accomplish this public demand, the system should provide a unique, permanent identifier for each animal or product that allows for that animal or product's movements to be tracked from the farm to the processing plant and finally to the consumer. Furthermore, the recent development surrounding the potential commercialisation of biotechnologically derived food animals, as well as the unapproved release of these novel animals into the public food/feed chain at least three times in recent years, has served to erode the public's confidence in both the technology and regulating authorities (21). Moreover, it has highlighted the concerns within the public with respect to the ability to ensure that products are both safe and of high quality. It has now become imperative that animal products and by-products be clearly labelled and traceable in order to ameliorate consumers' confidence and to enable consumers to make informed decisions with respect to the authenticity, safety and quality of their purchases. Recent surveys in the United Kingdom have shown that consumers want to be able to distinguish between biotechnologically derived products and those that are not (9).

One dilemma arises in how to differentiate genetically modified animals from those derived only through traditional breeding methods, or those derived through assisted reproductive techniques, including somatic cell nuclear transfer (SCNT)-derived clones. Current animal identification and tracing systems refer to an individual animal and, at best, a record of its ancestors but do not take into account the methodology used during the breeding stage. This kind of identification may help farmers and producers assess the efficiency of their production systems but provides no room for product tracing on the side of the consumers. It is important, however, that if these animals were to enter the food or feed chain, their movements and products could be traced in order to determine the long-term effects of these animals on human health and the environment, or for other socio-economic reasons. There are several available options for identifying biotechnologically derived animals, some of which are relatively new and others that are currently in place. This paper will focus on those with the most potential, including DNA-based tracing, internet tracking, radio frequency identification (RFID) and retinal imaging.

DNA-based traceability is most functional as a traceback system rather than a real-time tracing system. The basic principle is that every animal (excluding identical twins) is unique with respect to its genetic code, and that by using this genetic information, the animal itself and all products derived from the animal can be identified. This form of animal tracing requires two fundamental steps – DNA sampling and DNA analysis – with both steps being
performed on an initial reference and then a verification sample at a further point in the supply chain from a certain animal. Thus, a DNA sample taken from any point along the production chain can then be matched to the reference sample, allowing for the traceback to the animal of origin.

DNA sampling has been integrated by several companies into live-animal tracing systems, in that a DNA sample is obtained when the animal is tagged (14, 25). However, in theory DNA samples can be obtained from any biological tissue at any stage of the animal’s life. DNA analysis, on the other hand, is slightly more complex and usually must be done in a laboratory. Depending on the laboratory, the turnaround time between submitting the sample and receiving results can be anywhere from 32 hours (6) up to as long as 6 weeks (10). Most laboratories use either microsatellites or single nucleotide polymorphisms (SNPs) as DNA markers that are unique to individuals. SNPs are rapidly becoming the preferred marker as they are easier to interpret and are much more amenable to being incorporated into an automated system (30). Typically, only 30 to 50 SNP markers are required to verify that two samples of DNA are from the same animal; thus, a relatively large number of individuals can be screened in a small amount of time (17).

What little research has been done on using DNA-based tracing of animals shows promise. In 2003, IdentiGEN performed a pilot study tracking the movement of hogs from the farm to distribution. At various critical points along the production chain, tissue samples were taken from live animals (using the IdentiGEN biotag), carcasses, select cuts of meat, and from packaged meat on the store shelf. The results showed that 100% traceability could be achieved from the farm to slaughter (n=300); 97.5% from slaughter to boning (n= 40); and 96.9% from farm to supermarket (n=32) (21). In a different study performed by Davis et al. (6), it was shown that a 100% success rate could be obtained within 48 hours from blood and hair samples obtained from 232 live animals. It should be noted, however, that this study did not involve the slaughter and processing of any of the research animals, and all animals were located and remained on the same farm throughout the trial.

As previously mentioned, DNA-based traceability enables a sample to be traced back to the animal of origin. One benefit of this form of tracing is that DNA profiles can be stored in a database, limiting the need to repeatedly enter data on the animal, as only one reference sample is required. In addition, the DNA fingerprints of offspring can be evaluated against multiple potential sires to determine the real sire, which is particularly beneficial when pooled semen or multiple sires are being used in a production system. This animal tracing system is not without its drawbacks, however. For instance, there is the potential for contamination of reference or verification samples as well as tampering of the sample. In addition, if there is no reference sample in the database or if the reference sample is lost, then there are no reference samples to compare with the verification sample. This tracing system also will not work for identical twins as they have the same genetic information, and more research needs to be performed in order to determine if the DNA fingerprint from cloned animals is in fact identical to the cell donor. There is some evidence that the methylation of the DNA may be different between the clone and the original animal (20).

The tracking of food animals using the internet as a database is a relatively new concept although it is quickly being viewed as a viable option for tracking food animals through the production chain. The principle behind internet tracking of food animals is that the records and information entered by the producer are stored in a large database which can be accessed anywhere in the world, enabling rapid tracing of a given animal’s movements. The value of a system such as this is that up-to-date information can be accessed at any time, day or night. In addition, some companies such as AgInfoLink have linked both the premises identification
and the individual animal identification to allow for tracking of the animal to each destination (18). In the event that there is an outbreak of an infectious disease and the movements of the animal need to be known, a certain programme would generate a map complete with roads illustrating each premises that the animal had visited and potential cohorts that the animal may have come into contact with. Those cohorts or individual animals could then be traced to their final destination, and the spread of the disease could be rapidly contained.

Internet tracking is not without its drawbacks, however. The system would rely heavily on the use of another form of live-animal tracking, such as the use of RFID tagging, as well as the reliability of the producer to enter certain data. Given this, there is the potential that data could be incorrectly entered into the database or even tampered with. In addition, there is always the possibility with computers that there could be a system failure in which data is lost, perhaps permanently if insufficient backup has been provided. Of course, human error is a major factor with internet tracking, especially if the link between the data and the animal is broken; for example, the animal loses an ear tag, and the farmer replaces it with a different tag but neglects to change the information in the database.

The use of internet tracking for livestock is relatively new but holds much potential. It does, however, provide real-time information about animals and animal products that could be made available to both consumers and officials at any time of day. The ability of this system to be used for biotechnologically derived animals, however, is highly dependent on other forms of animal identification, as the system as a whole would be. Provided the other method of recognising the biotechnologically derived animals was sound, this system could function very well.

RFID tags are currently being used in Canada as a tracing system in the bovine industry, such that before any animal leaves the farm of origin, it must have in its ear a tag that is visually and electronically imbedded with a unique identification number allocated from the national database (5). This is a 15-digit number with the first three digits representing the country of origin and the last 12 digits representing the animal's unique identification number (5). An RFID device is composed of two main components – a transponder consisting of an encoded chip and antenna, and a transceiver/reader/interrogator/canner. To make the system more cohesive and easier to manage, a data accumulator and a software/data management system can also be used (7). The transponder can come in many different forms, including an ear tag, microchip, or rumen bolus, each of which have their own set of advantages and disadvantages. The reader is responsible, in the case of passive transponders, for sending electromagnetic waves to the transponder and charging it as well as reading the information that is sent from the transponder (7).

As this is the identification system that most livestock industries are implementing, much research has been conducted on both the durability of the devices and the ability of RFID to be used in a tracing system. Basarab, Milligan and Thorlakson (3) used 832 yearling steers and 3,354 yearling heifers in Canadian feedlots to study these two topics. They found that with the steers, there was an initial failure rate for the electronic identification (EID) tags of 0.12%, and with the heifers, the rate was 0.21%. For both groups, there was no loss of EID tags prior to slaughter. The traceback success rate for both groups, however, was not as impressive. The steer group only had a success rate of matching individual carcass data to feedlot data of 43.7%, and the heifer group was even lower, with a rate of 38.9%. The authors contribute these low values to a variety of mechanical and software errors as well as electromagnetic interference generated within the processing plant (3). General research into retention rates of the tags under field conditions done by Rusk (26) and Saa et al. (28) showed rates of 97% and 98%, respectively.
The value of using EID tags for the identification of livestock is that the tag is visible and can be used for visual identification. Also, the tags are easily located and removed at slaughter and do not pose a threat of contaminating meat. Moreover, the reader does not have to be in the line of sight of the animal to obtain a reading, and because passive EID tags do not have a power source, they have the potential to perform for the lifetime of the animal (29). EID tags can also be read/write tags so that much more information (perhaps the whole history of the animal) can be stored on the tag which would be attached to the animal at all times (19). However, as with any external form of identification, tags or buttons are vulnerable to being lost, removed or damaged. In addition, if a facility is not properly designed to accommodate multiple animals with EID tags, errors can occur with the reading of the transponder due to tag collision or electromagnetic interference (29).

Transponders in embedded chips injected into various body locations of different species have also been studied. Key concerns from all studies have been breakage, loss or failure of the transponder, migration of the transponder from its original injection site, contamination of meat for human consumption, and recovery of the device after slaughter (29). Initial attempts to implant transponders at the base of the ear were quickly discontinued due to a high incidence of migration and transponder failure (27% of 4,360 implanted) (11, 23). New evidence indicates that implantation at either the axilla or the nose generate a higher rate of reading success (97% and 90%, respectively); however, there is an increased difficulty in removing the transponder at the time of slaughter when these locations are used (16, 23).

Intra-ruminal transponders should also be considered as a method of electronic identification that is free from tampering or removal following insertion. One benefit of the use of these transponders is that there is less pain or physical damage than the injection of transponders (29). The major concern with rumen boluses is the loss of the bolus through regurgitation, which has been shown to reach up to 46% in calves (12); however, the loss due to failure of the transponder has ranged from 0% to 7%, which is equal to or lower than the embedded chips (4, 16). In addition, intra-ruminal transponders have been shown to be difficult to read in the live animal and can be difficult to retrieve after slaughter (8, 15).

The use of RFID in differentiating genetically modified animals from their unmodified counterparts could be employed. It would require the development of a separate set of identification numbers from the regular stream of animals, as well as careful monitoring and distribution of the devices in order to prevent unaltered animals from receiving the biotechnologically derived animals’ identification, and vice versa.

The concept of retinal imaging has been extensively explored in science fiction films and books. Recently, however, it has been considered as an option for tracing animals. Retinal imaging works on the premise that each individual (including twins and clones) has a unique retinal vascular pattern that is established from birth and does not change over the animal’s life (13, 31). The image is obtained using a scanning device developed by Optibrand known as an OptiReader™, which functions as a digital camera that uses near-infrared light to illuminate the animal’s retinal vascular pattern. The camera transmits full motion video at the rate of 19 frames per second to the controller’s display panel, and the computer within the controller determines which picture meets the required specifications for quality. The controller also contains a global positioning system, satellite receiver, and antenna that records the latitude, longitude, time and date, which is encrypted with the image at the time the image is captured. The available software makes matches between retinal images by using an algorithm that converts the image, based on the pattern, number and position of the vascular branches, and the diameter of each vessel, into a unique identification (31).
Research into whether or not retinal imaging can be used as a stable biomarker for the identification of livestock has produced promising results. A study by Whittier et al. (31) showed that there are a large number of combinations that will enable animals to be identified reliably based on their retinal vascular pattern. Moreover, they showed that the retinal vascular pattern from two sheep that were created as clones from the same adult parent material demonstrated that there is diversity between the two individuals, with very little similarity between the two images. Of course, more research with a larger sample population would need to be done in order to test this hypothesis thoroughly. Additional research done by Moss et al. (22) used 108 ewes to determine if retinal imaging could determine the identity of the ewes after they were mixed. Results illustrated that the Optibrand software was able to match the retinal images to the correct ewe 98% of the time. Moreover, Rusk et al. (27) determined that when retinal images were scrutinised by untrained individuals, they were able to be correctly matched 98.6% and 84.9% of the time for beef and sheep, respectively.

The advantages of retinal imaging for livestock are many. Retinal imaging provides a real-time identification of an animal that can easily be read by even an untrained individual. The vascular pattern of the retina does not change from birth and is different between individuals, including twins and clones. In addition, the technology developed by Optibrand limits the chance of tampering with the image or data as well as providing information that is permanently linked to the image. The camera used to obtain the image is largely non-invasive, and an experienced person can take one image every 15 seconds, all of which could be done during routine annual checkups or even at the birth of a calf (24). Like most technologies, it does have its disadvantages as well. For instance, the animal must be restrained in order to obtain an image. Images cannot be taken in direct sunlight in order to limit the amount of glare that is produced. As with any equipment, both the controller and the camera could be damaged during use, potentially destroying or damaging the data that is stored on the controller. Another disadvantage is sensitivity of the technology to unforeseen changes in morphology of the retina. For example, the animal might suffer some sort of eye damage, resulting from an accident, an infection, or disease that causes damage to the retinal vasculature.

Although more research is required to determine whether retinal imaging is a viable form of animal tracing, it is apparent that it could be used as a form of identifying clones amongst a population of their counterparts. The technology provides real-time animal identification that would be very difficult to tamper with and that would remain with the animal throughout its life.

The dilemma of how to separate genetically modified animals from their otherwise normal counterparts has come to the forefront. Various animal identification and tracing options are available, although not all are capable of performing this task. The options presented in this paper – DNA-based tracing, internet tracking, RFID, and retinal imaging – are those that could potentially be used to segregate and track clones, for example. Based on the information provided, none of the tracking systems presented here (i.e. DNA-based, RFID or retinal) can be considered fully reliable. The most adequate approach would involve a combination of physical (RFID and/or retinal) and molecular techniques. The information generated would then be stored in a centralised database which could be made available to various sectors depending on their need, through technologies such as the internet, as appropriate. Except for DNA-based or perhaps other molecular technologies, all presented techniques are highly prone to tampering.

Of the four possibilities, retinal imaging has been shown to be the most useful in the case of identifying clones, although no option is perfect. Regardless of which route is chosen,
complications are sure to arise in the form of technical difficulties and finances, to name a few. However, it is important to reiterate that animal traceability has now almost become a required part of the food, animal and public health industry in order to protect both the consumer and the livestock population that comprises much of the human food chain.

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