50 Million Tags and Counting

The changing face of the Australian beef industry

A Traceability Case Study

Rick Beasley
Operations Manager
National Livestock Identification System
Meat and Livestock Australia

Background

With around 28 million cattle, Australia does not have many cattle by world standards. Countries like India (330m), Brazil (170m) and China (130m) dwarf our herd numbers.

However, until recently, Australia was the largest beef exporter in the world. We now sit in second spot behind Brazil. Our large export quantities relate to our relatively small population and high levels of productivity.

For many years, Australia has enjoyed a reputation for producing high quality and safe beef. However, because of our dependence on exports, any disruption to the trade would have disastrous effects on the industry.
For this reason, the Australian beef industry embarked on an ambitious program to individually identify all cattle in Australia and record all movements and present locations of every animal.

**The Problem**

There are four main areas of concern facing the Australian beef industry:

1. **Exotic Disease**
   Being an island is a great advantage to Australia in that we have escaped infection with a lot of animal diseases which affect other countries around the world. The principle diseases are Foot and Mouth Disease (FMD) and BSE (Mad Cow Disease).

   This relative disease freedom allows Australia to be able to export to virtually every country in the world. Any outbreak of these diseases would lead to an immediate cessation of exports and total devastation of the industry until the disease was controlled. The ability to trace infected cattle quickly and effectively is central to any eradication plans.

2. **Endemic Disease**
   Whilst Australia has managed to avoid the worst of cattle diseases, there are diseases present which limit animal production or are potentially transmissible to humans. Tuberculosis and brucellosis have been virtually eradicated but a number of diseases, including anthrax, remain.

   Control or eradication of these diseases also relies on being able to identify infected animals and animals which could have been affected.

3. **Chemical Residues**
   Some chemicals which are used to treat cattle, or used for other purposes (such as timber treatment with organochlorides), may result in unacceptable residues in beef if not managed correctly. Treated or affected cattle need to be identified and withheld from slaughter until safe. Where contaminated cattle are found, companion animals also need to be quickly identified.

4. **Traceability and Product Integrity**
   There is an expectation amongst consumers that the food they purchase is safe and that, in the event of any integrity issue arising, product from the affected animal and all other companion animals can be immediately traced and removed from the food chain.

**The Solution**

The beef industry decided during the 1990s that the only solution to these problems was to individually identify each animal in Australia and to record every movement in a central database.
This was an ambitious plan, given the scope of the exercise – 30 million cattle in total with about 20 million cattle movements a year and an addition of 9 million born each year.

1. **Technology**

There are many technologies potentially available to identify cattle. However, it is essential that the system is machine-readable and that device numbers are read, stored and transmitted electronically.

After an exhaustive worldwide search, RFID was considered to be the only technology available which could deliver the requirements for such a system. Further testing resulted in the selection of low-frequency (134.2 KHz) half duplex systems complying with the ISO Standards 11784/11785. This technology has proven to be a good choice and we can now very quickly and accurately read large numbers of cattle electronically.

At this stage, Australia is the only country in the world which uses only RFID as the basis of a national traceability system.

2. **Infrastructure**

Cattle need to be read whenever they move – through saleyards, and abattoirs, and from one property to another. This involves a huge number of transaction files containing about 20 million cattle annually.

The infrastructure required needs to be tailored to each situation. This varies from simple hand held ‘stick readers’ to very sophisticated fixed-panel readers. Most of this equipment has been developed since the inception of the system. Rarely are the readers and software to meet the various requirements available ‘off the shelf’. You need to stimulate the demand before the commercial companies respond with the right gear.

3. **The Database**

The database development was commenced in 1999 and, as with most of these types of projects, will never be finished.

The NLIS Database is an online, internet-accessible system. Users can access the database and submit transactions through a website interface, or by submitting XML SOAP (Simple Object Access Protocol) transactions via third party software applications.

NLIS has a three-tiered architecture, comprising a database server, an application server and a web server. The NLIS Database operates on a Microsoft™ .NET platform, with business logic and rules accommodated in the SQL Server 2000 database (this is currently being upgraded to SQL Server 2005).
The NLIS Database currently accommodates:

- 5,263 uploads per day on average (95% processed within 3 minutes, 97% within 30 minutes)
- 69% of these uploads are queries
- 25,385 active accounts
- 180,457 Property Identification Codes – each PIC is a uniquely identified parcel of land
- 55,379,326 devices (39,507,897 active and 15,871,429 deceased)
- 35,037 transfers per day on average.

4. Additional Software
Centres such as feedlots, saleyards, abattoirs and some properties have management software already installed. We have assisted industry to interact with the database by encouraging software providers to upgrade their software to interact with the database or, in some cases, by developing bridging software to sit between the database and commercial software. This allows data to be automatically exchanged between systems.

The Result
The Australian cattle industry is now in the enviable position of being a world leader in cattle identification and traceability.

All cattle are now identified before they leave their property of birth and all movements and abattoir kills are recorded in the central database. This gives the industry the ability to almost immediately identify any animal health or residue problem, where an animal has resided throughout its life, who the companion animals were and where they now reside.

In addition, this level of product integrity gave Australia a marketing edge when selling product internationally. This is particularly the case in sensitive markets like North Asia and Europe and has been highlighted with the presence of BSE (Mad Cow Disease) in both North America and Japan.

An important aspect of the system is that it has provided the ability for the industry to use the tags to improve cattle management. The use of RFID technology enables individual animal data to be collected electronically, quickly and efficiently. This allows information on animal genetics, feeding and management to be combined with post-slaughter data to improve industry efficiency.

Provision of these types of systems comes at a cost. Not only is there the cost of developing the database and infrastructure, but there are ongoing costs of buying devices for each new calf added to the national herd.
The core system can justify the cost as insurance against catastrophic events and perceptions of product integrity. Like all insurance, the payout only occurs when disaster strikes, but the premiums have to be paid each year. The challenge is to add value to the complete supply chain by being able to identify individual animals rather than group-based averages.

Identification through the supply chain

The NLIS is designed to track animals through their lifetime and to slaughter. Like the timber industry, beef processing results in production of a huge product range from a single piece of raw material. Items produced from a single animal processed on a beef chain can be sold to as many as 50 different markets. To track all these products back to a single animal is almost impossible.

There are a number of systems used in beef processing to link production of meat and by-products back to the animals involved on a batch basis. Depending on the product or by-product involved, the batch size may vary from a single animal to a full day’s production. Primal cuts are typically linked to a production run of less than 100 head.

Trace-back is also facilitated in the beef industry by DNA sampling. Many beef processors take a DNA sample from each carcass processed and store the sample against the relevant identifiers, including the NLIS number of the animal involved. In the event that a trace-back is required, the DNA of the individuals in the batch can be compared with the target sample to determine which animal it came from.

Lessons learnt in the implementation of NLIS

The implementation of NLIS for the Australian cattle industry is now almost fully complete. From the beginning of the technology trials, this has taken 15 years. Lessons learnt over this period should be considered by other industries contemplating a similar course of action. A brief summary of these is as follows:

- **Industry Agreement**
  The NLIS program for cattle was instigated by the cattle industry and has been developed by a partnership between industry and government. This has resulted in the development of practical systems which meet the needs of industry and supply the information required by government to regulate effectively and ensure compliance.

- **Data Confidentiality**
  The issue of who owns the data will never be solved. The important point is who has the ability to access data and who can submit and
change data in the system. Industry consensus has to be reached and then reflected in comprehensive terms of use...

- **Central Database**
  If a central database is required, careful consideration needs to be given as to which organisation should develop and run the system. There are considerable advantages in the database being run by industry, with appropriate government access for regulatory purposes.

- **Technology**
  The technology used must be appropriate for the job that is required. RFID filled the requirements for the Australian cattle industry but there are other applications where visual tags, bar-coding, or other frequencies of electronic identification will be more appropriate or cost-effective.

- **Reliability of Technology**
  The technology selected for a purpose must perform reliably day in and day out. Technology which works at 99% is not good enough.

- **Supporting Systems**
  Identifying products is not an end in itself. Unless there are central or commercial systems which can use the information collected to make decisions, there is little point in identifying objects at all.

- **Understanding the problem**
  It is essential that the industry issues to be resolved are clearly documented and solutions found to address these problems.

**Conclusions**

The model used for the cattle industry in Australia will not be the best model for the timber industry. Each industry has its specific requirements and will develop unique solutions.

However, it does provide an interesting case study of how an industry and government came together to develop a system which helps both parties.

The system has already given Australia a large trade advantage and will deliver ongoing advantages in herd and supply chain management.