Information system technology for integrated animal identification, traceability and performance recording: the example of the Irish cattle sector

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Introduction

In the late 1990ies Ireland decided to establish a new infrastructure for Cattle Breeding and that was what took me from New Zealand to Ireland in 1998.

In 1997, Ireland implemented its animal identification and traceability system in accordance with EU directives for the purpose of controlling disease, primarily BSE, and providing quality assurance for Irish beef.

This paper is focused on the information systems used in Ireland to support three main objectives: disease control, beef quality assurance and cattle breeding. Ireland is now at the forefront of cattle breeding worldwide. Any country can achieve this, but not on its own, and not without an excellent identification and traceability system.

Industry

The Irish cattle industry comprises some 2 million cow-calvings per year with 1.1 million in dairy herds and 0.9 million in suckler beef herds. The industry produces a wide range of milk, meat and other animal products with a high percentage exported after processing in Ireland. Returns from milk coupled with larger herds means that dairy farming is currently financially more sustainable than suckler beef operations.

A feature of the Irish cattle industry is a relatively high level of cross breeding. Some 20% of calves born to dairy cows are sired by beef breed sires. The suckler herd comprises a large percentage of first and second crosses of beef breeds on dairy breeds. The cows in suckler herds are frequently crossed with terminal beef breed sires to produce slaughter animals. This integration of the dairy and beef herds has led to a cattle breeding infrastructure that supports breeding for both dairy and beef purposes.

Organisation

Three organisations are primarily involved in the implementation and exploitation of the integrated identification system operating in Ireland; The Department of Agriculture Food & the Marine (DAF), Animal Health Ireland (AHI) and the Irish Cattle Breeding Federation Soc. Ltd (ICBF).

Department of Agriculture Food & the Marine (DAF)

DAF is a Government Department with responsibility for:

- Policy advice and development.
- Representation in international and national negotiations.
- Development and implementation of schemes in support of Agriculture, Food, Fisheries, Forestry and Rural Environment.
- Monitoring and controlling aspects of Food Safety.
- Control and audit of public expenditure under its control.
- Regulation of the agriculture, fisheries, and food industries through national and EU legislations.
- Monitoring and controlling animal and plant health and animal welfare.
- Monitoring and direction of State Bodies engaged in: research, training and advice; market development and promotion; industry regulation and development; commercial activities.
- Direct provision of support services to Agriculture, Fisheries, Food and Forestry.

The budget of DAF was some • 3 million for 2011.

Animal Health Ireland (AHI)

Established in 2009:

- AHI is an industry-led, not-for-pro?t partnership between livestock producers, processors, animal health advisors and government.
- It focuses on diseases and conditions of livestock that are endemic in Ireland, but which are not currently subject to regulation. Examples of diseases covered include: BVD, Johnes, IBR, and Mastitis.
- It uses the information infrastructure provided by ICBF.

AHI has an annual budget of •1 million.

Irish Cattle Breeding Federation Soc. Ltd (ICBF)

ICBF commenced operation in 1998 with the goal of improving the genetic merit of the national cattle herd.

ICBF's members and owners are four groups of organisations:

- The Artificial Insemination (AI) co-operatives.
- The organisations providing Milk Recording (MR) services.
- The Herd Books (HB).
- The Farm Organisations (FO) representing farmer interests.

The Board of 16 members includes one from DAF, 3 from each of the AI, MR and HB and 6 from FO. The shares are held in three groups of 18% (corresponding to AI, MR and HB) and 46% by the FO.

The stakeholders, all four groups above, in cattle breeding control the decisions made by ICBF.

ICBF has an annual budget of •5 million.

Databases

Databases are tools for storing large volume of data in a way that facilitates rapid access, high levels of data integrity, minimal duplication and low costs.

Modern cattle breeding, disease control and quality assurance are all based on data. All three involve the same animals, and it thus makes sense to take an integrated approach to develop the databases underpinning each of these.

The systems currently operating in Ireland are the result of a large investment of EU and National funds.

There are two databases:

- The DAF database holds the master copy for all births, movements and deaths. These events are collected from all cattle farms and from those organisations involved in the export and import of live animals, the sale of animals from farms, and the slaughter of animals in Ireland.
- The ICBF database receives a daily "feed" from the DAF database of all births, movements and deaths in the herds (some 90% of all) that are involved in the ICBF database. The ICBF database supports a wide range of services provided by the cattle breeding service providers in Ireland, including the Herd Books, for dairy, beef and dual purposes breeds, and the milk recording, beef recording and artificial insemination services.

The DAF database supports the control of regulated diseases (FMD, TB, Brucellosis, BSE, etc.), beef quality assurance, farmer payments - including the single farm payment - price reporting and a number of other functions of DAF.

The ICBF database supports cattle breeding, farm management information and the control of non-regulated diseases through the activities of AHI.

These two databases operate with minimal duplication of data storage and perhaps more importantly data collection. The ICBF database is totally dependent on the DAF database for all new animals, all movements and all deaths. This enables the cattle breeding industry to avoid what used to be a substantial operational cost and ensures that farmers do not need to face the cost of providing the same information to multiple organisations.

Ireland, as do many other dairy cattle breeding countries, participates in Interbull. Interbull provides a mechanism for ICBF to evaluate bulls from all other participating countries in the Irish base and scale for all relevant traits and breeds. In this way, ICBF is able to evaluate the potential value to Irish farmers of bulls from the thirty other countries that participate in Interbull. Interbeef is currently being established to perform a similar function for beef breeds and traits.

The Interbeef model is slightly different to the Interbull model for dairy. It involves a database of individual animal phenotypes, rather than sire evaluations, from participating service users. These phenotypes are used to compute international beef genetic evaluations that are incorporated in local genetic evaluations. Interbeef services are currently under development (Wickham and Durr, 2011).

The rational for Ireland to participate in both Interbull and Interbeef is essentially the same. These collaborations provide a scientifically sound system for Irish breeders to evaluate the genetic potential of seed stock from other cattle populations worldwide.

Of particular importance from identification point of view is that Interbull and Interbeef use the same standard for the international identification of cattle.

All data of relevance to cattle breeding in Ireland is now held in the ICBF database. The system has been designed to avoid any duplication of data collection. Data is collected from many sources including:

1. Farms,
2. DAF's official system for calf registration and animal movements in accordance with EU regulations,
3. meat factories for all cattle slaughtered in Ireland,
4. animal sales for animals sold by farmers to other farmers and exporters of live animals,
5. artificial insemination service providers,
6. milk recording organisations,
7. laboratories for testing milk, disease testing and genotyping,
8. dairy & beef linear scorers, and
9. the genetic evaluation system is tightly linked to the database, sourcing data from it and storing results in it.

Information from the database is provided to farmers through services from many organizations, including those providing milk recording services, herd book services, artificial insemination services, farm advisors, veterinarians, milk processors and researchers.

Farmers also have direct access to the database, and to the data and information on their own herd and animals through the ICBF HerdPlus® service.

The general public can obtain a wealth of information from the ICBF website, *www.icbf.com*.

In summary, the ICBF database is a tool for use by the Irish cattle breeding industry to simplify data collection and to improve the quality of the information that is provided to farmers, either directly or through the providers of services to farmers.

The ICBF database has grown rapidly and now accounts for over 90% of all cattle, dairy and beef, in Ireland. Recent growth has been stimulated by the Suckler Cow Welfare Scheme. This is a beef industry initiative addressing issues associated with animal welfare and data recording in suckler beef herds. It has been funded by DAF and has resulted in a dramatic increase in the amount of data, in particular records of the sire of each calf, from commercial cattle.

One of the most significant deficiencies of the EU identification and traceability system was that it did not give due recognition of the value that would be created through animal breeding and other uses. For example, if the recording and validation of sire was given equal status to the recording and validation of dam at the point of calf registration, then the quality and quantity of animal breeding data would be dramatically increased.

Technology

Two technologies have proven to be particularly valuable in the recording of data and the provision of the information in Ireland.

- Handheld computers.
- Web.

Handheld computers

ICBF has made and is making increasing use of handheld computers for collecting data. This particular technology enables technicians to visit farms where there is no internet or even mobile phone coverage, and to capture data during the visit. Examples include linear scorers, milk recorders, artificial insemination technicians and veterinarians.

In the case of artificial insemination, the technician, prior to the visit to each farm, populates the handheld computer with records of all animals known to be on the farm and during the visit to the farm records the details of each animal inseminated by him (or her). This population process and upload subsequent to the farm visit, requires the technician to have access to a mobile phone network. Most importantly, the technician is able to validate the identification of all animals serviced.

Prior to the availability of this system, insemination data (date, bull, cow) was paper based, it used to take several days and weeks for all data capture to be completed and it involved such high levels of animal identification errors that the data could only be used for billing purposes. It could not be loaded to the database and used for reproduction, research or genetics.

After the handheld computer system was implemented in 2004, an electronic record was collected on the farm with a printed receipt left on farm, identification of the cow inseminated was validated on the farm before the technician leaves, and an accurate record was loaded onto the ICBF database within 24 hours of the insemination. The overall cost did not increase.

In the future, the technology will play a major role in reducing the cost of data collection, improving the accuracy of the resulting data and enabling cattle farmers to be more profitable. However, its success depends on the ready availability of accurate identification and location data for each animal.

ICBF current implementation of handheld computers is more complex and expensive than a web based system. It is seen as an interim solution until there is reliable access to the internet on each farm where cattle breeding services are being provided.

Web

The second technology that is revolutionising the use of integrated identification and traceability is the internet and the world-wide-web.

Prior to use of the internet, there were a small number of access points to ICBF database. This meant few people could access to data directly, resulting in both higher costs for information distribution and higher costs for data collection.

Since the introduction of this technology, there are now a large number of access points to ICBF database including directly by any farmer with internet access, much easier change management as the software has only be to updated in one place, lower cost of information distribution as much of this is now electronic and direct to the person seeking it, and lower cost of data collection as in many cases the person originally collecting the data is the person adding it to the system.

Outcome - one example

Here is one cattle breeding example which illustrates the impact that an integrated system can have on the cattle industry.

Since 1970, the rate of genetic change of a series of traits important to dairy farmers can be readily estimated from the ICBF genetic evaluation system. During this period, there were two events of particular significance. In the early 1980ies, Holstein cattle

from North American breeding programs were introduced and over a number of years came to dominate the dairy herd. The second event occurred in 2001 when the Economic Breeding Index (EBI) was introduced.

Over this period, the genetic merit for milk volume showed a rapid and substantial gain following the introduction of Holsteins and a plateauing with the introduction of the EBI.

Over this same period, the genetic merit for fat and protein yield showed a similar increase following the introduction of Holsteins but did not show the same plateau as milk yield with the introduction of the EBI.

In contrast, survival and calving interval both showed significant deterioration with the introduction of Holsteins and a significant reversal of this trend on the introduction of the EBI.

The explanation for these trends can be seen by retrospectively assessing the trend in the EBI. The EBI is an assessment of the genetic merit for farm profit and is an index that places negative weighting on milk volume, positive weighting on fat and protein and positive weighing on improvements in survival and calving interval. These weightings are a reflection of the economic impact of trait changes on farm profitability.

With the introduction of Holsteins, there was no improvement in the genetic merit of the Irish population of dairy cattle to produce profits. The introduction of the EBI, with its focus on profit, resulted in a rapid improvement.

This example illustrates both the power of genetics to bring about change and more importantly, if used effectively, to bring about improvements in farm profits.

However, of much more importance in the context of the subject of this paper is that our ability to conduct such an analysis with comparative ease, is a direct reflection of the very effective infrastructure provided by a well-integrated identification system and a well-organised database.

Conclusion

Animal breeding is a unique and powerful tool for improving the profitability of cattle farming.

Irish animal breeding has been transformed through a unique partnership between farmers, the breeding industry and DAF..

The national identification and traceability system adopted by Ireland has greatly facilitated Irish cattle breeding.

The model established relies heavily on international cooperation and collaboration.

Membership and full participation in the activities of the International Committee for Animal Recording and Interbull are fundamental to the achievements of Ireland cattle breeding.

List of references

AHI Website: *www.animalhealthireland.ie*

ICBF Website: *www.icbf.com*

DAF Website: *www.agriculture.gov.ie*

Wickham BW and JW Durr (2011). A new international infrastructure for beef cattle breeding. Animal Frontiers, Vol. 1, No. 2, pages 53-59.