New Zealand TRADE & ENTERPRISE

Livestock Traceability

Review of Current New Zealand Databases

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Contents

1 Executive Summary

This report provides a moderately high level view over some of the databases that are currently used for animal recording in New Zealand. In the light of recent proposals from the Animal Identification and Traceability Working Group, and much public discussion about the role of traceability technologies and ICT, it is appropriate to survey the existing databases, to understand their capability, and the potential for interconnection or participation in a traceability solution.

One of the key questions for the implementation of a national traceability system is whether a new database should be created to contain that information, and how large that database should be. There are also a number of considerations for such a system in terms of ongoing support and maintenance, data integrity, and the level of appropriate data extraction and security. The review of these existing databases can provide us with valuable learning for new national systems.

This report was prepared as a component of a project undertaken by Innovation Waikato and the Farmgate group, a consortium with members including MediaLab, Telecom, Fonterra, Massey University, and Wool Equities. The overall project examines the role of information and communications technologies (ICTs) in assisting traceability and integrated farm management for New Zealand farmers.

Our conclusion is that the existing databases were not designed as individual animal traceability solutions. Two of the databases do have excellent individual animal recording capabilities, and all of the databases may have some role to play in an eventual solution. A national traceability solution will require individual animal traceability and movement tracking, as well as robust farm and herd location information, and animal diagnostics.

2 Introduction

2.1 Background

In May 2004, the New Zealand LAPTYS committee[1] convened an Animal Identification and Traceability Working Group to consider traceability and

[1] The Livestock and Animal Products Tracing and Information System (LAPTYS) Programme, Ryan T, Proceedings of the Food Safety & Biosecurity Branch NZVA, 2004

identification needs within New Zealand[2]. The Working Group brief was to consider systems for cattle and deer, but also to take into account other species such as sheep, pigs, horses, and goats[3].

The Working Group delivered its recommendations in July 2005, proposing that each animal be assigned a unique number (including bobby calves), and each property or site be identified by a Property Location Number (PLN). These numbers would be issued by a single body with a central database, to which other industry databases could be linked. The database would track tags issued, movements, and slaughter or death, and possibly other optional data. The Working Group refrained from specifying tag, reader, communications protocol, or database technologies in its initial proposal.

2.2 Traceability Database Review Project

During 2004, Innovation Waikato and the Farmgate group proposed a programme of research and collaborative development activities around traceability and integrated farm management systems. Established in 2003, the Farmgate group includes MediaLab Limited, Fonterra, Wool Equities, Massey University, and Telecom New Zealand. The programme of work has been funded by New Zealand Trade and Enterprise, with matching funding from industry.

This report fulfils one of the original objectives of the traceability and integrated farm management project. It provides a high level overview of key New Zealand livestock traceability data sources, identifying the ownership and management of that data, and ongoing developments. The authors from Massey University and Wintec interviewed stakeholders with management and technical responsibility for these databases and systems.

There is a degree of challenge in preparing this report. Our goal is that it should form a useful adjunct to ongoing work by the Animal Identification and Traceability Working Group. We have had to make assumptions about the features that will be useful in the future New Zealand livestock traceability landscape.

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[2] Support Information Systems for Animal Tracing, Hellstrom J & Moore D, April 2004 (discussion document available at http://www.biosecurity.govt.nz/pests-diseases/animals/animal-tracing-system.pdf, and submissions at http://www.nzfsa.govt.nz/animalproducts/publications/consultation/submissions/analysis/laptys-review-post-submissions.pdf).

[3] Terms of Reference for the Animal Identification and Traceability Working Group, 21 May 2004.

The Working Group proposes “that existing identification systems be enhanced and that electronic tracing of animals be implemented using a centralised register of core data which approved users can access.”

Hence we have attempted to understand the structure, accessibility, and connectivity of the existing databases.

The biosecurity and market access goals of the proposed framework are “to…

- Limit the spread of a potential disease outbreak and minimise food safety and animal health risks
- Improve the speed of deployment of animal tracing and subsequently containment measures within New Zealand; and
- Reduce the period for which access to key markets might be denied while importing countries are assured that any disease outbreak has been managed and risks are under control.”

As a result, we have also focused on data collection methods and the frequency of update of the existing data systems, as well as learning about disaster recovery or business continuity planning for the services.

Most of the existing databases have been in place for a number of years, although they are all under active maintenance and ongoing development. Two further databases are in the process of being commissioned:

- The Animal Health Board has implemented a new livestock database and tag register for Tb purposes, and this was due to be commissioned in July-August 2005.
- The VetPAD database and recording tools for veterinarians is being developed by Massey University. We interviewed the VetPAD team and asked the same questions as the existing databases, as a point of comparison. You’ll find the VetPAD review in section 10, but it is not compared in the summary tables.

2.3 Project Team

The questionnaire used in this study was designed with input from Dr Mark Stevenson, Kevin Lawrence, Prof. Dr Klaus-Dieter Schewe, and Madre Chrystall (Massey University), Heather Wickham (Wintec), and Andrew Cooke (Rezare Systems).

The interviews and report preparation were carried out by Steve Kieu, Norm Osborne, and Heather Wickham (Wintec), and Madre Chrystall (Massey University).

3 Methodology

The data/information gathering process for this project was by questionnaires and interviews.

A questionnaire was designed to gather key information from selected animal based commercial industries within New Zealand. Three perspectives were targeted to gain an overall view:

1. organisational and management overview;
2. data;
3. technical

The interviewees were selected by the organisations involved, and included both management and technical personnel. These personnel were selected for the type of information they could provide:

- management: high level 'big picture', strategic view
- technical/data: specific, detailed, current data and systems information

The interviewees were sent a copy of the questionnaire prior to the interview to enable them to preview the type of questions that would be asked. These questions were primarily closed questions, as specific information was being sought.

Each interview (8 in total) involved the interviewee and up to two interviewers. Where more than one interviewer was involved, one interviewer asked the questions, but both interviewers recorded the responses. The second interviewer sought additional clarification to answers if necessary.

The information gained from these interviews is the basis for this report.

See Appendix A : Management Questionnaire

See Appendix B : Technical Questionnaire

4 Summary

4.1 Coverage and Capability

Organisation	Purpose of Database	Industry Sector	Portion of Sector	Types of Documentation	Data Supplier	Development Team
AgriBase	biosecurity investigation/response food safety authentication livestock traceability disease management commercial purposes	Dairy, beef, sheep, deer , pigs, poultry, horticulture, forestry	Close to 100%	Full user, system and development documentation	Farmers, Field Officers, Auditors, LINZ, Quotable Value	20 developers and 2 database administrators (shared with NLDB)
MINDA	Dairy farm management Herd Improvement Reports to farmers	Dairy, beef sheep, dairy goats	96% dairy, 5% - beef – 60% - dairy goats and minimal sheep	Full user, system and development documentation	Farmers, Laboratories, Vets, Contractors	40 developers and database administrators, 15 support staff (help desk, customer support personnel)
NLDB	biosecurity investigation and response food safety authentication livestock traceability disease management – TB, EBL	Dairy, cattle, deer, Equine, apiary	Close to 100% dairy, cattle, deer	Full user, system and development documentation	Farmers, Field Officers, Auditors, Vets, Testing Officers	20 developers and 2 database administrators (shared with AgriBase)
SIL System	Sheep breeding database Reports to breeders through bureaus	Sheep, deer	60% sheep seed stock (1-5% nationally) 20% deer seed stock (2-5% nationally)	End User Documentation Specific complex procedure documentation	Breeders Bureau Laboratories Vets	Small technical and IT teams, outsourced, one key developer

As the table illustrates, all databases claim multi-sector coverage. In practice, AgriBase and the NLDB have a large coverage across all New Zealand farm types. The depth of individual animal recording in these databases is limited however, compared to MINDA and Sheep Improvement's SIL System.

The development and support team sizes vary considerably, and to an extent this reflects the difference between (for instance) recording 96% of dairy farms, vs. 5% of all sheep farms. In practice, members of larger teams will not all be working on the core database, but it does mean that the resources are available should they be required.

Database	Records Farms	Records Herds	Records Individuals	Track Movements	Data Validation	Database Platform	Updating
MINDA	Address and Location	Yes	Yes	Yes (herd to herd only)	Thorough, through MINDAlink or data entry	IBM DB2 on Sun Solaris Linux	24/7 via email, fax, Excel, CSV and text files
SIL System	Address only	Yes	Yes	Yes (breeding flock to breeding flock only)	Thorough through SILEnt and file import	JADE 6 on Windows Server 2003	24/7 via upload interface from Bureaus, who use email, CSV and text formats
AgriBase	Yes (detailed)	Enterprise numbers	No	Planned	Stored procedures, database constraints	SQL Server 2000 on Windows Server	Daily as required from field officers and Tb testers, etc. LINZ every 3 months Quotable Value monthly
NLDB	Yes (linked to AgriBase)	Yes	No, but linked to Tag Register of tags issued	Planned	Stored procedures, database constraints	SQL Server 2000 on Windows Server	Daily as required from field officers, testers, inspectors. Annually for dairy and pig data.

Only MINDA and the SIL system provide individual animal recording. This is a function of their core competency – breeding and animal management. These databases can track animal location and past locations where this has been recorded. However, they do not currently track the transport and yard mixing of animals, which has implications for disease control. Only AgriBase has a detailed set of farm records, including identifying multiple titles that compose a farm (these are often non-contiguous).

We have not attempted to include details of identifiers for the main entities in this table. These are discussed in section 5. The main entities for each database are covered in more detail in each of the sections 6 through 10.

5 Key Identifiers

The database systems studied have all risen from differing needs. The identifiers used within systems have in most cases been designed to suit a specific industry or business purpose, and as a consequence the systems have different approaches to identification of key entities.

Some correlation is possible where frequently used secondary identifiers have also been stored. These include such as global positioning system (GPS) coordinates, Dairy supplier numbers, and RAPID numbers as part of rural addresses. However even the definition of a *farm*, for example, is subject to interpretation. The following summarises the differing systems of identification.

5.1 Farm

AgriBaseID is a number used across the AgriQuality databases: AgriBase, NLDB, and Tag Register, and defines a business of one or more parcels of land which may be disparate. VetPAD also uses this to identify the owner of an animal.

GPS coordinates are used by AgriBase to indicate the centre of the business unit. MINDA uses them to indicate the farm where a herd is located. Fonterra also uses GPS coordinates to identify the location of tanker entrances for their suppliers.

RAPID numbers are stored by AgriBase and VetPAD, and may be stored in the other databases if they have been supplied by the farmer as part of the address. Rapid numbers must be combined with a road name and a town or area.

Valuation Roll number amalgamates land title information for rating and valuation purposes, which in turn can be used to form farm units. These are stored by AgriBase.

Dairy Supplier numbers are a unique number for dairy collection points within a diary company (such as Fonterra or Westland). They are stored by AgriBase, Tag Register, and VetPAD.

5.2 Herds and Flocks

AHB 7-digit herd numbers are used for beef and deer herds by the NLDB and the Tag register.

Dairy Supplier number is used by NLDB as an additional identifier. This is perhaps not a strictly correct usage as herds and collection points are not the same, but is a useful link nevertheless.

LIC Herd Number is a unique herd identifier issued by Livestock Improvement Corporation.

SIL Flock Code is a unique flock identifier issued by Sheep Improvement Limited. It identifies a breeding flock regardless of location; a farm may have more than one flock, and may have commercial animals that do not form part of the breeding flock.

5.3 Animal Identification

Composite Birth Flock/Herd, Year Born, and Tag Number keys are used by the Tag Register, MINDA, SIL System, and VetPAD, although each has a different flock or herd component.

Physical Visual (Management) Tags comprising Year Born and Tag Number are supported in various forms by the Tag Register, SIL System, MINDA, and VetPAD.

Radio frequency identification (RFID, sometimes called electronic identification or EID) is supported by NLDB, MINDA, SIL System, and VetPAD. ISO 11784 RFID codes are typically a 15 digit number or a 16 digit number if a check digit is included. Other standards may use longer codes, such as 19 digit numbers.

Current ID is an alternative identification used by the SIL System when an animal changes ownership. It comprises the new Flock ID, year born, and the tag number of the animal, possibly with a prefix to differentiate it from other animals.

	AgriBase	MINDA	NLDB	SIL System	VetPAD
Flock/Herd ID					
Agribase ID	✓		✓		✓
AHB Herd Code	✓		✓		✓
Other Herd/Flock		✓		✓	
Contact Person	✓	✓	✓	✓	✓
GPS Location	✓	✓	via AgriBase		✓
Valuation Roll No.	✓		via AgriBase		
RAPID Number	✓	Some	via AgriBase	Some	✓
Dairy Supply No.	✓		via AgriBase		✓
Pork Industry No.	✓		via AgriBase		
Animal ID					
Birth Composite ID		✓		✓	✓
Visual Tag		✓	Tag Register	✓	✓
RFID/EID		✓	Tag Register	✓	✓
Current Composite ID				✓	

6 AgriBase – AgriQuality

6.1 Organisation Profile

The AgriBase database comes under the AgriQuality umbrella. AgriQuality is a SOE which emerged in 1998 as part of the re-organisation of MAF. Its aim is to become the best partner for food safety and biosecurity services in Australasia. A branch of AgriQuality can be found in most rural centres.

The AgriBase system (servers and database management) is based at the Christchurch AgriQuality office, whilst the operational management team is based at Palmerston North.

AgriBase is a geo-spatial database of farm positions, farm owners and managers, farm enterprises including livestock numbers and types. It has information on over 105,000 farms (including lifestyle properties). Provision of information is through geo-spatial "layering" of data, providing an instant visualisation of the spread of data types, for example, the location of all dairy farms. A feature is the ability to "zoom in" to an ever increasing level of detail.

Development of the database had already begun in 1993 in response to a recognised need for a national spatial farm database, incorporating a GIS environment. The concepts where initially developed at the Epicentre, Massey University, as the EpiMAN project, then deployed under MAF Quality Management, which became AgriQuality and the database became AgriBase.

The database covers all primary sector farms – all livestock, horticulture, including forestry, market gardens, vineyards etc. For those sectors where there is some "Regulatory body or board" coverage is 100%. For instance coverage of dairy, beef, sheep, deer, pork producers, poultry and apiarists should be close to 100%, however for other minority sectors such as Alpaca contribution is voluntary and coverage unknown.

The key objectives of AgriBase are:

- to provide biosecurity investigation and response
- food safety authentication
- livestock traceability
- disease management.

Due to heightened awareness of the need for traceability, the database was reengineered in March 2005 to a schema which would facilitate expansion and the development of integration with other existing database systems.

6.1.1 Interviewees

Dr. Robert Sanson, Epidemiologist, provided both the management perspective and technical IT perspective. He has been instrumental in the development of the database since its conceptual development at Massey University between 1988 and 1993.

6.1.2 Development and Maintenance Capability

The database is a core responsibility of the 15 -20 personnel IT team, based in Christchurch, Hamilton and Palmerston North and which includes two dedicated database administrators (DBAs).

Up-to-date industry standard user manuals are available. Developer documentation such as the detailed database schema is maintained.

6.2 Database Entities

The focus of the AgriBase database is on the farm as a business unit. The basic entities covered by the schema are:

- People, role, farms, land parcels, rating units, project membership, homestead and gate locations, dominant enterprise, herds/flocks, animals numbers by species / class, ANZSIC codes, sub-farm spatial areas.

The entity relationship diagram in Figure 1 gives a simple high-level overview of the main entities.

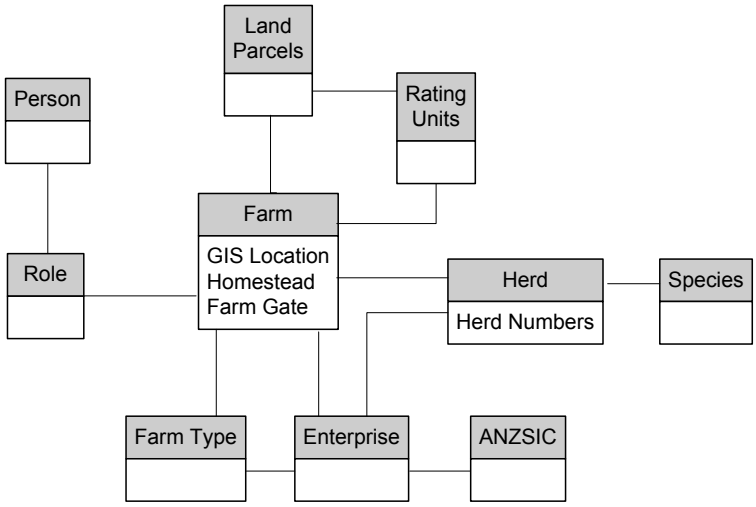

Figure 1 AgriBase core entities

Land parcels are identified by GIS information and related to **rating units** and land title information.

Farm is a farm business unit defined as one or more parcels of land, and one or more rating units. Each farm is identified by a national farm ID. Farm size and physical location details are stored including location of the homestead on the farm and the location of the farm gate. Sub-farm spatial areas define enterprise land-use such as cropping, forestry, horticulture, grazing.

Each farm business unit has a single dominant **Farm Type** representing one or a combination of **Enterprise** types (e.g. mixed sheep and beef represents a mix of two enterprise types). Farms have one or many **Enterprises**.

Herd information includes animal numbers by class/species and herd/flock on farm. A herd ID in common with the Animal Health Board is used. Herds are an **Enterprise**, (e.g. beef breeding herd, deer fattening herd). Individual animals are not identified.

Enterprises have an associated ANZSIC code.

Role information such as owner, manager and key decision maker are mandatory for a farm business unit.

People stores name, address, phone and other contact details.

A search for a farm by owner or national farm id will result in a geographical location of the farm centre so that all parcels of land are represented in the output.

6.3 Data Management

Data management covers the data formats, methods of data entry, data validation, backup and recovery and archiving employed by AgriBase.

6.3.1 Data Formats

Data is collected by various means, electronic and paper-based reports, and from various sources. Apart from the land information provided by LINZ and Quotable Value, data is not systematically collected or rigorously controlled.
Farmers/producers are a major source of information which is collected on a voluntary, often opportunistic basis by AgriQuality Field Officers and by mailouts. On-farm audits, TB testing and pest controls etc provide updates.

6.3.2 Methods of Entry

Data is updated as it comes to hand, which in practice is on a daily basis. Data entry is performed in the Christchurch and Palmerston North offices. LINZ data providing land title information is updated every 3 months. Quotable Value data is updated monthly.

6.3.3 Data Validation

Data validation is maintained by stored procedures at the application level, and primary and foreign key and integrity constraints on the database ensure validity and integrity of the data.

6.3.4 Backup, Recovery, and Archiving

A full back-up is carried out nightly, and a Disaster Recovery Centre in Palmerston North, which mirrors the database in Christchurch, means recovery can be implemented on demand.

Since 1998 data has been archived every 3 months.

6.4 Platforms and Architecture

AgriBase was developed using Microsoft SQL Server7, and has just been upgraded to SQL Server 2000. The database and associated applications were developed in-house using PowerBuilder, Java, and Cold Fusion as development platforms.

The database is running on multiprocessor Windows servers, comprising database (SQL 2000), Web servers (using IIS and Apache web server and Cold Fusion

application web server) and Citrix. The Citrix server provides access to remote sites. Applications require standard desktop computers.

Peripheral systems include mobile iPaq devices incorporating Vodafone GPRS broadband communication protocol, as well as GPS systems, plotters, scanners, laminators, wide format map printing.

6.5 Connectivity and Query Options

Connectivity is concerned with how access to the database is delivered to the user and the ability to connect to/integrate with other databases or systems.

AgriBase is a multi-relational database enabling interrogation by location, species, event, and time. Access can be tailored to client requirements.

Access to the database is provided through a client/server application in PowerBuilder using a WAN to the server in Christchurch. Web access is also provided with a Cold Fusion based on-line search facility. A Java desktop application allows map-based views and spatial updating. The application incorporates spatial data layers which are served off the Christchurch web servers. There are also ad-hoc data retrieval solutions using stored procedures and user defined SQL.

Data extraction is currently undertaken using ODBC, OLEDB, JDBC, isql, query analyzer, embedded SQL, command line BCP for bulk upload/download, and using SQL Enterprise Manager tools. Field officers use mobile iPaqs incorporating Vodafone GPRS broadband communication protocol to transfer data.

As Figure 2 illustrates, AgriBase is integrated with a number of AgriQuality and external databases (Figure 2 was provided by AgriQuality).

Updated datasets are passed to MAF every 3 months. Data is published on the website and used for example by animal health diagnostic laboratories, and by veterinarians at meat plants engaged in residue sampling.

Regular connection is made to LINZ to update land title information through data dumps and to the National TB database with the Animal Health Board for purposes of integration of data. A herd ID in common with the Animal Health Board is used. Both the herd and farm ID are used in common with the National Ear tag Register. This means that although individual animals are not identified by AgriBase, the relationship of animal to farm can be made.

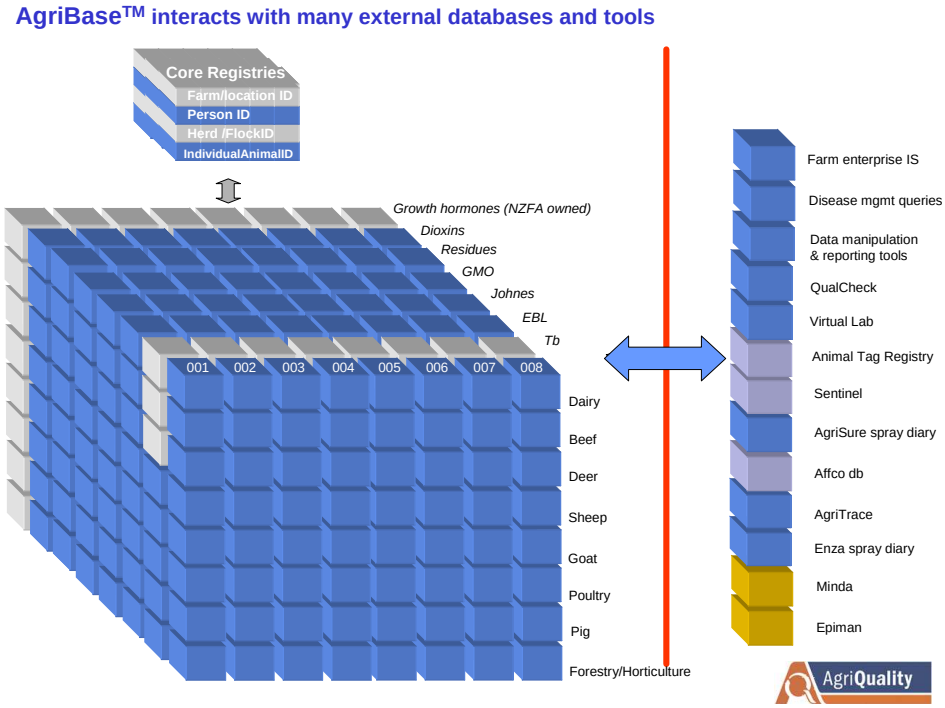

Figure 2 AgriBase connectivity illustrated

6.6 Future Developments

With regard to the future, the database schema was recently redesigned to facilitate the development of integration with other existing databases; the ability to add on "classes" means the schema can be easily extended to suit future requirements. Upcoming plans include map based services to clients via the internet.

7 MINDA – Livestock Improvement Corporation

7.1 Organisation Profile

Livestock Improvement is a user owned co-operative, owned by some 12,500 farmer users of its products and services. Livestock Improvement provides a range of solutions for pastoral agriculture, particularly New Zealand's dairy industry. Their mission is "Leading the world with genetics and knowledge to create wealth for pastoral dairy farmers."

Livestock Improvement provides high rates of technology transfer, national farm management and breeding strategies, and has delivered the highest rate of genetic gain (for the New Zealand environment) of any dairy industry in the world.

Livestock Improvement supplies a broad range of services, including dairy animal recording, herd testing, maintenance of the national dairy database, and the animal evaluation unit that ranks New Zealand's dairy animals. The company also operates two Test Link dairy laboratories, at Hamilton and Christchurch, as well as DNA Testing and analysis, and a number of R&D ventures. Artificial Breeding services are a key component of the business, and extension activities are provided by their nationwide field service.

Livestock Improvement has offices in the United Kingdom, Ireland and Australia with agents in the United States, and sells semen to such countries as Argentina, Brazil and South Africa[4].

Livestock Improvement has a long history of establishment dating back to 1909 when it carried out the first herd testing operation. In 1927 it introduced a calf identification service and in 1935 artificial insemination research began. In 1967 their first IBM computer system was installed to record all Livestock Improvement Association herd-testing records.

The national database design began in 1980 when ancestry, herd testing and artificial breeding information from the six autonomous Livestock Improvement Associations and the dairy breed associations (Jersey, Friesian, and Ayrshire) were loaded onto the national database. Since then the development and improvements relating to herd improvement, farm management, organisational growth and expansion, technology and systems has been continuous and innovative.

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[4] http://www.lic.co.nz/main.cfm?menuid=1&sub_menuid=7#

The EBL control scheme was introduced in 1996/97, the first example of a disease traceability system using herd test milk samples and the Livestock Improvement national database. Since then the development in traceability has been continual.

The key objectives for Livestock Improvement are:

- Dairy farm management
- Herd improvement
- Breeding worth
- Reporting to farmers

Sectors of industry Livestock Improvement covers:

- Dairy over 96% nationally
- Beef 5% nationally
- Dairy goats 60%
- Sheep (minimal)

7.1.1 Interviewees

The table below shows the personnel interviewed for this project:

Name	Designation	Perspective
Graham Gaylard	Traceability Development Manager	Organisational / management
Craig Purcell	Manager Business Information	Technical / data / development

7.1.2 Development and Maintenance Capability

Livestock Improvement systems are developed mostly in-house. They have a large IT development team with approximately 40 staff including database administrators (DA's), designers, developers, and analysts. Another 15 people work as support (help desk, client support etc).

Livestock Improvement has full system documentation and full user documentation in various formats (text, video, and presentations), and complete development documentation is also available.

New development adheres strictly to recognised methodologies of the full SDLC (software development lifecycle).

7.2 Database Entities

Livestock Improvement has approximately 700 tables in their database. They also hold all New Zealand herd owner details (who may not be Livestock Improvement customers) in a core database. As a result they are able to identify every dairy farm in New Zealand. Figure 3 is a very simplified high-level E-R diagram of the main entities.

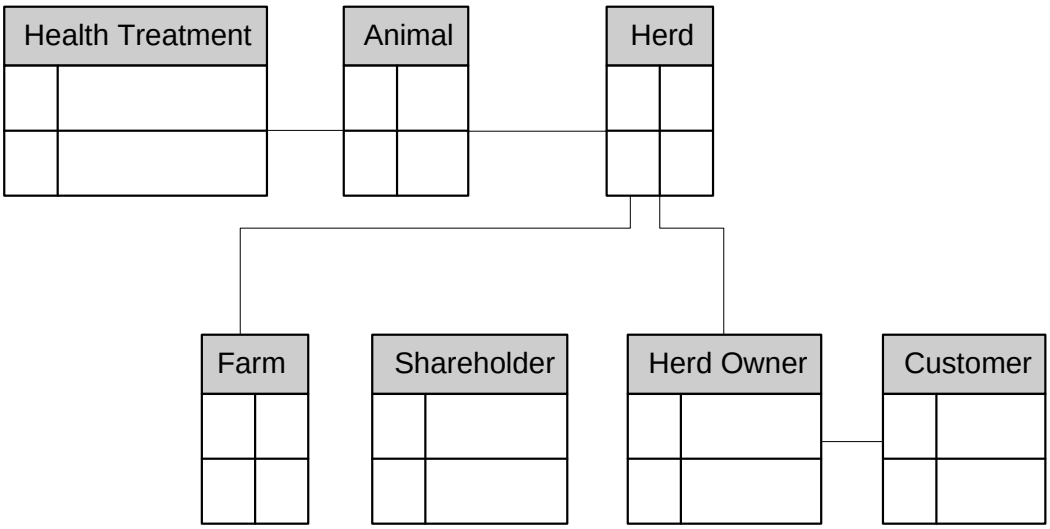

Figure 3 MINDA core entities

Animal information recorded includes the breed and species of each animal, the date of birth, physical and electronic tags, parentage (as well as pedigree and stud records), status (alive, sold, culled, and now also export), AI (artificial insemination) and ET (embryo transfer) flags and DNA markers.

Animal health treatments, herd tests, mating and calving, and location and movement records are stored.

Figure 4 shows how animals are identified, and how treatment and movement information forms part of the animal record.

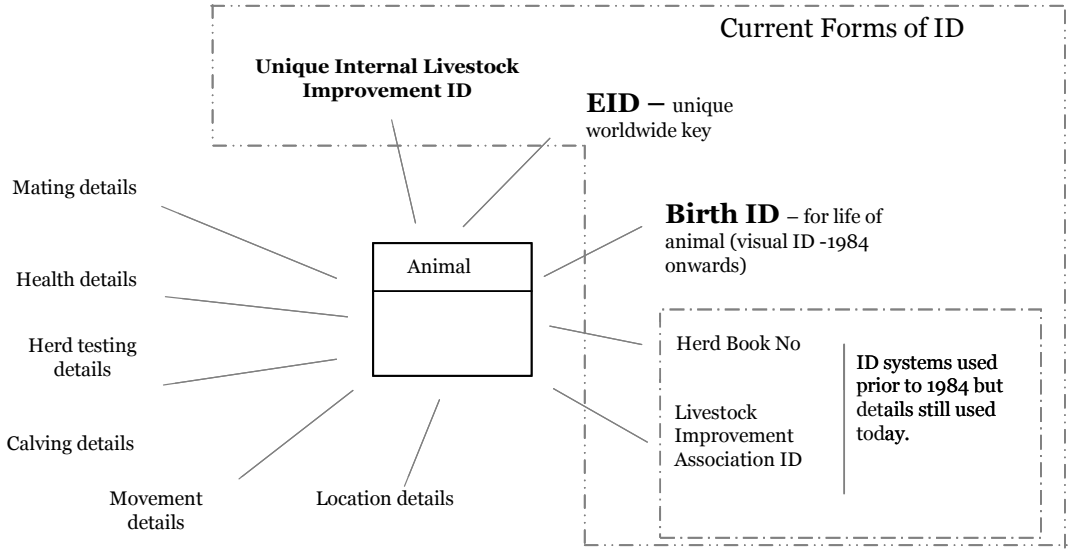

Figure 4 Livestock Improvement animal identification

The primary key is a unique Livestock Improvement internally generated key, utilising components of the ID (ABCD-YY-XXX).

Herds are identified by herd number and farm location. Each herd at the same location must be the same species. If a herd is using any Livestock Improvement service, a 'herd code' will be allocated, and the participant code of the herd owner (4 characters) must be unique to that herd during the Livestock Improvement season (1 June through to 31 May).

Herd Owner details are collected as part of the annual service order process. The name and contact details are verified each season, as is the legal status of the shareholder.

Each **Farm** location's GPS reference is recorded along with region, road name and herd number. The herd number relates only to Livestock Improvement customers.

Shareholder entitlements are derived from the value of LIC services.

Customers are any person, partnership, or organisation of interest to LIC. The majority of their customers are herd owners, but there are also a number of breed society members, semen suppliers, and laboratories etc who are recorded as customers.

7.3 Data Management

Data management covers the data formats, methods of data entry, data validation, backup and recovery and archiving.

7.3.1 Data Formats

Livestock Improvement receives their data/information in a variety of formats: fax, email, electronic reports, Excel spreadsheets, text file and CSV formats. All new systems are being designed for electronic exchange.

7.3.2 Methods of Entry

Farmers (approximately 12,000) supply their own data/information to Livestock Improvement, which is loaded into the system daily. The information can be supplied by paper, phone, or email, or farmers can enter their own herd and health details directly into MINDAlink. MINDAlink is a PC based software application which is free and can be downloaded from www.lic.co.nz or provided on a CD. Farmers using the website for access require a username and password.

Contractors supply live weight information and herd test information electronically, and DNA labs supply genetic information electronically. Veterinarians supply animal health/treatment information. Although data can still be supplied on paper the majority of information is received in agreed electronic formats.

7.3.3 Data Validation

The MINDA software application has its own data validation checks and entry warnings. The I21 Rule System imposes a high level of data validation. Examples of errors resulting from the validation are:

- Purchase: New test number must be allocated if no birth identification supplied
- Purchase: Birth ID does not match EID
- Removal: Animal has already left this herd
- Removal: Animal is already current in another herd
- Movement: Cow is current in the herd but was not current on the movement date
- Movement: This cow has recorded events after the movement date, the latest is dd/m/yy
- Movement: Future date

Database synchronisation checks and data warehouse data checks are an automatic process. The data warehouse is updated every 24 hours while farmers using MINDAlink / pro are able to synchronise their data as frequently as they wish.

7.3.4 Backup, Recovery, and Archiving

All information within the national database is held live on-line and has been since its inception. Prior to 1985 all data is stored on tape records.

Livestock Improvement has a daily, weekly and monthly back-up cycle. They have full business recovery systems in place and a duplicate recovery site located in Auckland, which could be up and running within hours of a major event at the Ruakura site.

Raw data sent from farmers to Livestock Improvement is also backed up daily to compact discs.

7.4 Platforms and Architecture

The system is built on top of IBM DB2 database management system running on 4x Sun Fire V880 Service (mainframe) and small amount of Linux – Intel based servers.

Apart from the SQL and DB2 environment, the Delphi programming language is widely used for development work. Livestock Improvement utilise an Informix Database for their Online Transaction Databases, and an IBM data warehouse product.

Livestock Improvement is currently in the process of migrating from Sun hardware to an Intel Blade server.

7.5 Connectivity and Query Options

The communication protocols used are the standard: ftp, http on top of TCP/IP network.

The system connects to other 10-15 other databases, which includes competitors' databases for data input and output, and data services.

Livestock Improvement can run a variety of pre-designed traceability report queries:

- Animal and herd locations and movements (within a defined radius)
- Herd owner details (within a defined radius)
- Farm locations (within a defined radius)
- Animal health treatments

See Appendix C: Sample LIC Traceability Report.

7.6 Future Developments

The Livestock Improvement system can currently provide a complete history of all animal and herd movements, the farms locations (within a defined radius) and herd owner details, within a very short period of time for animals and locations currently stored in the database. When the Waiheki Island incident happened a few months back, Livestock Improvement was able to print off all herd locations and farms details within a 60km radius 2 hours of notification. Animal movements would be another set of queries, which Livestock Improvement could run if required.

A future development is 100% traceability compliance which will involve the inclusion of third part locations (e.g. sale yards and trucking firms).

Livestock Improvement has a 'continuous database development strategy', which also includes keeping their systems up-to-date. The interviewees reinforced that traceability is also about providing excellent support to the farmer.

8 NLDB – AgriQuality

The NLDB (National Livestock Database) also comes under the *AgriQuality* umbrella. It is a database of herds of dairy and beef cattle, pigs, deer, and potentially equine and other species. Discussion is proceeding on the inclusion of poultry information.

Coverage of species by the database is close to 100% for cattle and deer, 100% of pigs and equine.

Development of the database was initiated in 1995 under the Ministry of Agriculture primarily to store information on the TB testing and histories of dairy and beef cattle and deer herds.

A series of disparate databases under the *AgriQuality* umbrella have been significantly upgraded to provide integration of data. In particular the 2 significant databases: AgriBase and the National Livestock Database (NLDB) are now integrated along with the Animal Treatment Information System (ATIS) and the Tag Register.

The key objectives of NLDB are:

- to provide biosecurity investigation and response
- a disease management tool in particular
- bovine TB
- EBL (Enzootic Bovine Leucosis)
- Pork Industry Board herd register.

The NLDB is not a standalone system. On its own it provides information on herds and their disease history. Full functionality is provided through integration with the ATIS and the Tag Register which enables tracing of individual animals. It has been fully integrated with AgriBase since 1998.

8.1.1 Interviewees

Chris Carter, Technical Manager for Farm Network, provided both the management perspective and technical IT perspective.

8.1.2 Development and Maintenance Capability

The database is a core responsibility of the 15 -20 personnel AgriQuality IT team, based in Christchurch and Palmerston North and which includes two dedicated DBAs.

Up-to-date industry standard user manuals are available on the intranet. Developer documentation such as the detailed database schema is maintained.

8.2 Database Entities

The focus of the NLDB database is on herd and disease information. The basic entities covered by the schema are: People, herd/flock, disease, and farm.

People are owners and managers of the herds. Name and contact details are recorded.

Herd/Flock is identified by a 7 digit identifier in common with both the Tag Register and the ATIS. Individual animals can be identified through the Tag register.

Farm is identified by the AgriBase id. All farm details recorded with AgriBase are accessible.

Disease records the disease identified against the herd. The herd ID links to the Animal Treatment Information System (ATIS).

Integral to the functionality of the NLDB is its links to the Tag Register and to the Animal Treatment Information System (ATIS), both of which are maintained by AgriQuality. The ability to record animal movements on an individual/mob basis has been implemented.

An overview of the relationship between these key databases is shown in Figure 5.

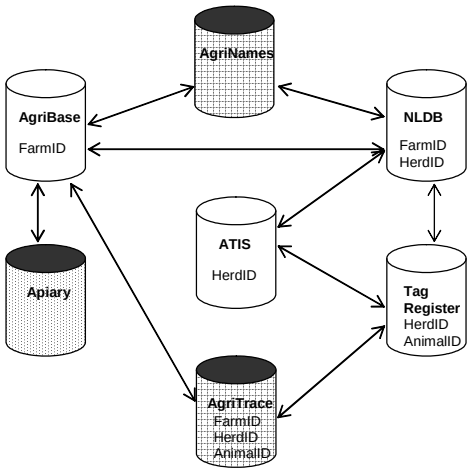

Figure 5 NLDB Database relationships

8.3 Data Management

Data management covers the data formats, methods of data entry and data validation that are particular to the NLDB. The database backup and recovery and archiving is managed by AgriQuality along with the other databases that it hosts.

8.3.1 Data Formats

Data is collected by various means, such as electronic and paper-based reports, and from various sources. AgriQuality Field Officers, individual farmers, Tb testing, and now hive inspectors all provide data for the database. Data on the dairy industry and pig industry is updated annually.

8.3.2 Methods of Entry

The national ID scheme for bovine tuberculosis requires farmers to identify animals over a month old prior to movement, and an order for ear tags updates the Tag Register. Data is updated as it comes to hand, which in practice is on a daily basis. Data entry is performed in the Christchurch office.

8.3.3 Data Validation

Data validation is enforced with stored procedures at the application level and primary and foreign key and integrity constraints on the database ensure validity and integrity of the data.

8.3.4 Back-up, Recovery, and Archiving

The database backup and recovery is managed by AgriQuality. A full back-up is carried out nightly, and a Disaster Recovery Centre in Palmerston North, which mirrors the database in Christchurch, means recovery can be implemented on demand.

Since 1998 data has been archived every 3 months. When a herd or farm disappears or is deregistered for some reason, the information is archived. Data is updated on a 3 yearly cycle.

8.4 Platforms and Architecture

The system was developed using Microsoft SQL Server7, and has recently been upgraded to SQL Server 2000. The database and associated applications were developed in-house using PowerBuilder, Java, and Cold Fusion as development platforms.

The database is running on a multiprocessor Windows server using IIS and Apache web server and Cold Fusion application web server. A Citrix server is run at remote sites. Applications require standard desktop computers, and peripheral systems include mobile iPaq devices incorporating Vodafone GPRS broadband communication protocol.

8.5 Connectivity and Query Options

Updated datasets are passed to MAF every 3 months. Data is published on the website and used by animal health diagnostic laboratories, and by veterinarians at meat plants engaged in residue sampling.

Web systems provide ad hoc reporting, structured reports, spreadsheets and XML data. FTP access is also provided.

Staff access is through a WAN to the server based in Christchurch, some users have terminal services in a Citrix environment.

Specific tasks are undertaken for specific clients, and access can be tailored to client needs.

AgriBase, NLDB, ATIS, and the Tag Register are all integrated.

8.6 Future Developments

The two significant databases under AgriQuality, AgriBase and the NLDB, are now integrated along with the Animal Treatment Information System and the Tag Register. Future development plans include the incorporation of Apiary data, and animal movements. The existing AgriBase database schema, which was reviewed and updated in March 2005 provides for integration and expansion.

9 SIL System – Sheep Improvement Limited

9.1 Organisation Profile

Sheep Improvement Ltd is a wholly owned subsidiary of Meat & Wool Innovation Ltd, which provides sheep and deer database management and genetic evaluation services through their Genetic Engine model and central database. It facilitates the development of industry good sheep breeding technology and more recently deer.

The SIL system is a tool for ram breeders and commercial sheep breeders to help them identify the best sheep genetics for their requirements. The delivery structure of this information is primarily through eight main independent bureaus retailers who can provide report customisation for the breeder, although individual breeders can access the system directly if they wish (see Appendix D: SIL System Overview).

In 1999 following the consolidation of a number of independent sheep recording schemes (AnimalPlan, Flocklinc and Studfax) SIL was formed to manage the national sheep database for the New Zealand sheep industry. The data from these various schemes was merged into a single database, operated on behalf of the industry by SIL. SIL is jointly owned by Meat NZ and the NZ Wool Board. SIL commenced full commercial operations in 1999.

The National Flock Recording Scheme NFRS was formed in 1967 and peaked in 1974 with 630 flocks and 170,000 recorded ewes. Sheeplan was formed in 1976 to provide performance recording and in 1988 it was transferred to Animalplan, which in the form of Animal Breeding Trust continues to provide bureau services for SIL today. Flocklinc was formed in 1989 and also operates today as a SIL bureau. The Studfax bureau system continues to act as a medium to facilitate PC based interaction with SIL.

The SIL system operations and database management is provided under contract by AgResearch at Invermay and Ruakura. The Genetic Engine, which is the heart of the genetic analysis, operates from Invermay and the database resides at Ruakura. This is a very valuable relationship to SIL.

Sectors and percentages of industry SIL covers:

- Sheep : seed stock 60% (nationally 1 – 5%)
- Deer : seed stock 20% (nationally 2 – 5%)

The key objectives for SIL are:

- A single national sheep breeding database with standardised analysis and outputs
- A reliable and accurate Internet based transfer and analysis system
- A marked increase in the utilisation of performance recording by all sectors of the sheep industry.

9.1.1 Interviewees

The table below shows the personnel interviewed for this project:

Name	Designation	Perspective
Richard Wakelin	Manager - Genetics	Organisational / management
Neville Amyes	Data Manager/ Research Technician	Technical / data
John Davys	Senior Consultant	Technical / software development & operations

9.1.2 Development and Maintenance Capability

SIL provides in-house management and advisory services through The General Manager, a consultant based at Christchurch and a number of independent advisors.

Technical development is outsourced to AgResearch, and is composed of:

- The Genetic Engine development team is based at Invermay. Some Genetic Engine development is also outsourced to Abacus Biotech (Dunedin)
- A System Administrator and the General Manager work together to determine the priorities of all developments
- A Data Administrator is based at Ruakura
- An IT team with a database software developer (subcontracted to AgResearch from Rezare Systems Ltd, Hamilton) plus AgResearch operations staff.

User documentation is available.

High-level, easily readable integrated languages are used in development (including the database schema), so with the small development team, additional developer documentation is mostly limited to a small number of specific complex procedures.

9.2 Database Entities

The SIL central database stores online data for approximately 8 million animals (5.4 million active), from around 800 active flocks (from a total of 3,000 recorded) covering 75 breeds, and with 16 million measured traits, 40 million derived traits and around 430 million breeding values.

Figure 6 is a very simplified high-level E-R diagram showing the main entities:

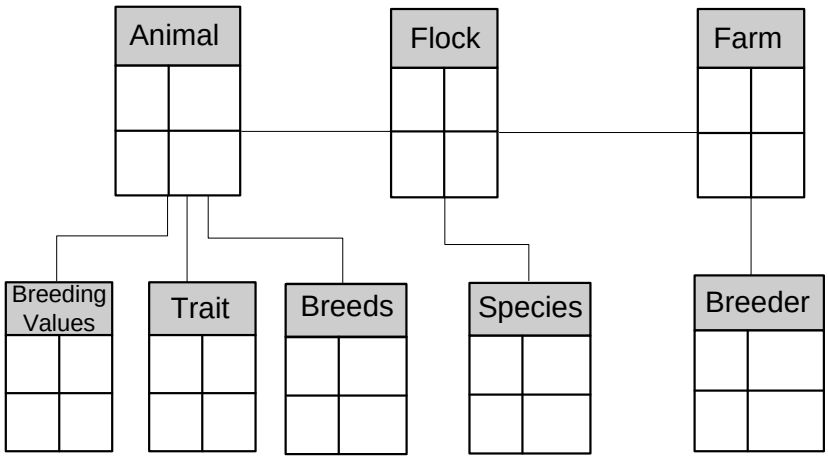

Figure 6 SIL System core entities

Animal may currently be either sheep or deer (although other species are allowed for). Each animal is identified uniquely by its *Birth ID* (this ID stays with the animal for its entire life. Birth ID means the combination of birth flock, year born & born tag)

Duplicates of animals may exist on a farm (but not in the database) and in such cases it may further be identified by a coloured plastic tag on the animal on the farm and definitely by a prefix in front of the Birth Tag in SIL – for example: "111.G234/03.2003" (Birth Flock, Birth Tag, and Year Born). Among other things, the following information is also recorded:

- Birth Flock (also identifies the farm address)
- Pedigree (parents and siblings, birth dam, rearing dam, genetic dam)
- Unique DNA bar code (if DNA testing carried out)
- Current Status = 'Alive' and Status Date = 'birth date' of animal. If the Current Status = 'Transferred' then the Status Date will be the 'date of the transfer'. Later a Current Status may equal 'Died', in which case the Status Date = the 'date of death'.

If an animal is sold to another breeder, it receives a further new ID referred to as *current ID* (which consists of the new current flock code, a new current tag number and of course the original year born ID remains the same).

Electronic IDs (RFID codes) are recorded for breeders who use this technology.

Flock is the primary way of organising animals. Each flock has a numeric code, and a farmer may have more than one flock. Flocks are often categorised by the primary sire and dam breed for reporting purposes. If an animal is sold to another farm, its current flock code changes to the new flock.

Animals may be further divided into mobs, which represent different environments or management on the same farm, but still belong to the same flock.

Traits are measurements and records: a trait code (such as live weight, fleece weight, eye muscle area, or worm count), date of recording, recording flock and recording mob IDs, and the trait valve. Traits can also be defined for a number of other purposes.

Breeding Values are the results of genetic analysis (eg calculating breeding values etc) calculated by the Genetic Engine.

Farm location and owner name details are recorded.

Breeder (also referred to as farmer or owner) name and address details are recorded.

Currently the only movement tracking of animals is transfers between flocks, where a ‘transfer status’ and ‘date’ are recorded. Transferred animals retain their birth ID (for the flock they were born in) and receive a current ID (for the flock they are transferred to), so details of birth location, past locations, and current location are recorded.

9.3 Data Management

Data management covers the data formats, methods of data entry, data validation, backup and recovery and archiving.

9.3.1 Data Formats

The SIL central database accepts data uploads from users in CSV formatted text files. Bureaus may receive data from their clients in any number of formats, often as spreadsheets or electronically from data loggers.

SIL users receive information back from the system primarily through emails and attachments, where the attachment may be a: report in PDF format, a genetic trend graph in PDF, Word format, data summary, or an extract in a text file.

9.3.2 Methods of Entry

A user of the SIL System may be an administrator, a farmer or a data entry person who works in a Bureau on behalf of the breeder.

Any authorised user (person with a username and password) may log on to the central system through the internet (24/7) to edit their data online through a number of customised edit screens provided by the SIL System through JADE Thin Client technology. This is best for editing small numbers of animals and is also the way that breeders request reports.

For large amounts of data, users can submit data files of animals and traits into a queue for the SIL system to process. Typical information submitted from users includes new animals, fleece weights, weaning weights, and fate codes (death notice).

A stand-alone data entry program called *SILEnt* is available that runs on the users' local computer to facilitate the production of these bulk data files in the correct format to be processed by the central system. Alternatively bureaus may choose to prepare the files using their own systems.

9.3.3 Data Validation

Data validation occurs when a user (the breeder, administrator or data entry personnel) enter data into the SIL database. There are many validation checks, including weight ranges and other data ranges, age, pedigree check and dates. When the data is processed, any erroneous data is excluded and reported back to the submitter.

SILEnt performs a number of validation checks for users during data entry, and more checks are performed by the central system on the uploaded files before accepting the data into the database.

SIL are currently developing a data-auditing tool, designed to further improve the integrity of the data.

9.3.4 Backup, Recovery, and Archiving

The database is backed up nightly, and an additional monthly backup is performed and stored off-site.

The database system also keeps a transaction log so that in the event of power failures the system can return to a consistent state with minimal loss of data and time.

All data uploads, data extracts, reports created and genetic data calculated by the Genetic Engine are archived, with the most recent 3 months kept online and older data written to tape or DVD.

9.4 Platforms and Architecture

The central database and supporting SIL System application is written in JADE Version 6, an object-oriented language and database management system developed and supported in New Zealand (www.jadeworld.com).

Some functionality is provided through components called by JADE, including custom components written in either Delphi or Visual Basic, and the reporting output uses Crystal Reports components.

Recently, SIL have been testing using Microsoft SQL Server 2000 to store the volatile breeding value data received from the Genetic Engine and this is likely to be implemented in time for use this current season.

The SILEnt data entry program is written in Microsoft Access.

SIL are planning an upgrade of the hardware platform to a Storage Area Network which will be shared by the current production JADE database and application server and a new SQL server.

The current hardware uses HP/Compaq Proliant servers running Windows Server 2003. Hardware RAID controllers provide striped and mirrored disk access and fault tolerance. The central database is currently 130Gb in size.

Breeding Value calculations are carried out on one or more “Genetic Engine” computers, which run statistical packages.

9.5 Connectivity and Query Options

The standard TCP communications protocols, FTP and HTTP, are used.

The various Bureaus provide their own Client Management and Billing Systems, and use the SIL system to:

- store their clients’ animal data
- calculate breeding values

- provide reports and data to breeders

The Genetic Engine produces breeding values, which are then available through the SIL System reports, which can be customised by the users (breeders, Bureaus and SIL administrators) depending on what information is being requested.

There is no direct connection between the SILEnt data entry program and the JADE central system; all data transfers take place through file export/import facilities of the SIL System.

All access to the central SIL System is provided through the JADE Thin Client software, which provides a rich (high functionality) user interface on Windows (with a Java version under development) on a WAN/LAN. Secure Sockets Layer (SSL) extensions encrypt the traffic between the client and the application server. The Thin Client works satisfactorily even over slow dial-up connections.

JADE also supports a web browser interface and web services, although these are not currently used by SIL. JADE databases can also be accessed through an ODBC driver or a DLL that provides a programming interface for other tools.

SIL can run limited traceability report queries:

- Animal birth place
- Animal current farm location
- Flock/animal transfer details

9.5.1 Future Developments

SIL are looking at more Across-Flock genetic reporting in the future and improving data validation through a data-auditing tool.

Traceability could be added should it become an industry or legislative requirement.

10 VetPAD – Massey University

10.1 Organisation Profile

VetPAD has been developed by staff and students of the EpiCentre, Massey University, Palmerston North. The EpiCentre - part of the Institute of Veterinary, Animal and Biomedical Sciences within the College of Sciences at Massey University maintains a large portfolio of local and international research activities. Fields of research range include endemic diseases such as lameness in dairy cattle, respiratory disease in pigs, tuberculosis in farmed animals and wildlife.

The EpiCentre has extensive involvement in the development and application of animal health software (EpiMAN, DairyWIN, PigWIN), and is also experienced in the use and integration of a wide range of software for epidemiological uses.

The VetPAD project is a surveillance information system designed for the timely gathering of veterinary clinical diagnoses of farm animals. It incorporates the use of Pocket PC PDA's carried by veterinaries on farm and in clinics. The system is currently at the beta-testing stage and being trialled by 8 veterinaries from different centres.

VetPAD was developed from a recognized need to capture the veterinary clinical diagnoses of farm animals in a centralised format which would allow analysis and provide a surveillance system. The database will cover all large domestic farm animal disease/health issues as diagnosed by veterinarians. Previous records were paper based. The project was funded in part by MAF.

The key objectives of VetPAD are

- To capture veterinary clinical diagnoses of large domestic farm animals
- To provide a surveillance system
- To provide a platform to allow analysis of data
- To provide an early warning system

10.1.1 Interviewees

Lachlan McIntyre, Consultant Epidemiologist, provided both the management perspective and technical IT perspective. The development of the VetPAD project formed part of his Masters thesis.

10.1.2 Development and Maintenance Capability

The database is a responsibility of the 4-6 personnel Epicentre IT development team. They maintain a set of user help files, and limited developer documentation.

10.2 Database Entities

The focus of VetPAD is on animal health. To capture the information "Veterinary Tasks" form the core of the system. The basic entities covered by the schema are: Clients, staff, tasks, animals, animal groups, places, schedules, submissions, diagnoses, treatments, and drugs.

The diagram in Figure 7 gives a high-level overview of the main entities.

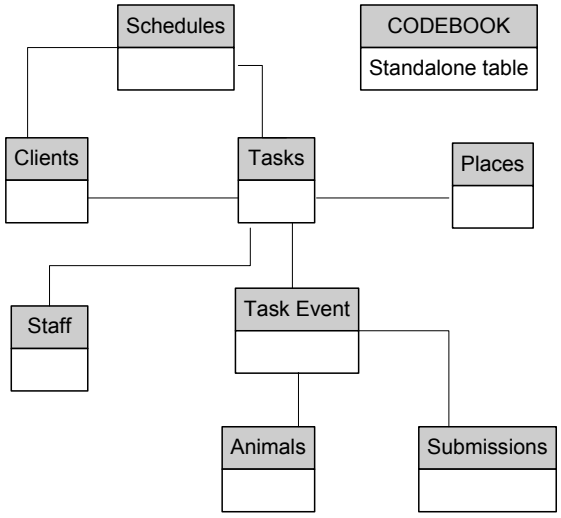

Figure 7 VetPAD core entities

Clients are the farmers requiring veterinary services. Name and contact details are recorded along with the RAPID rural location number (distance from start of road), AgriBase ID and dairy company supply number (if applicable). Location details include the farm area and GPS coordinates.

Staff are the veterinarians and consultants providing the service. They are identified by an ID number and Veterinary registration number. Name, company, contact details and location are recorded.

Places gives the location of the farm or clinic.

Schedules are the veterinary appointments and **Tasks** are the basis of the call-out. Dates are recorded.

Task Events are the subtasks resulting from the call-out and link to individual animals.

Animal information recorded includes the VetPAD unique ID, physical tag, electronic id, species and breed, date of birth, gender, an optional photo, and the status – alive, dead on farm, or put down by vet.

Submissions cover the submission of samples to laboratories from sick, at risk or dead animals. At present this is not implemented as there are no participating laboratories.

Codebook records diagnoses, treatment procedures, species, breed, veterinary drugs/treatments, product packaging (quantities per pack for prescriptions).

Codebook is a standalone table which is contained in the handheld PDA's. It has a dynamic, hierarchical tree structure which allows the user/vets to enter diagnoses, treatment and drug information on site. Data is later downloaded using a middleware "Codebook Maintenance" application to a copy of the VetPAD database and to other veterinary clinic applications. Diagnoses of individual animals are identified. Apart from vets other typical users could be veterinary pharmaceutical company representatives and MAF surveillance officers.

10.3 Data Management

Data management covers the data formats, methods of data entry, data validation, backup and recovery and archiving employed by VetPAD.

10.3.1 Data Formats

The VetPAD project is still under prototype development and provision of data will remain voluntary for some time. The expectation is that data will be collected by participating vets for all diagnoses of significant large animal health issues.

10.3.2 Methods of Entry

At this prototyping stage electronic records are entered into the VetPAD handheld PDA's on site by the veterinary and uploaded to a copy of the VetPAD database on a PC in the veterinary clinic. This is zipped up regularly and emailed to the EpiCentre where the data is extracted for update. Investigation into other technologies is ongoing and can be implemented, for example regular automated transfer of data to a central server.

10.3.3 Data Validation

Primary and foreign key and integrity constraints on the database will ensure integrity of the data.

10.3.4 Backup, Recovery, and Archiving

Standard procedures are in place for overnight backup of all PC's in the EpiCentre. At present the database is stored on a Consultant epidemiologist's computer workstation, and mirrored on the developer's machine.

The VetPAD project is concerned with capturing data, long-term storage and archiving is not an issue as yet.

10.4 Platforms and Architecture

The VetPAD project was developed using a Microsoft Access database and C++.

The database is on a desktop computer running Windows XP. Peripheral systems are the handheld PDA's.

10.5 Connectivity and Query Options

The only current end user is the consultant epidemiologist at the EpiCentre. For the participating veterinaries data is downloaded to their own copy of the VetPAD database through MS ActiveSync.

External outputs are electronic only at this stage. The system is capable of handling/exporting csv files and XML files which can be published on the web.

The project was developed with the potential to connect to KODAVET. KODAVET is a Swiss Veterinary Service initiative comprising an integrated IT system for data management including disease surveillance and outbreak management facilities, and GIS functionality. This system will connect all Swiss Veterinary Services and include data from the Swiss National Animal Movement Database and the National Database of the Federal Office of Agriculture. It was planned for implementation in January 2005.

10.5.1 Future Developments

The database schema itself is still under development can be easily extended to suit any future requirements. Upcoming plans include realisation of the connection to KODAVET. This would provide a standardised repository for long term storage of data.

Appendix A Management Questionnaire

NZTE Traceability & Integrated Farm Management

There are three groups/types of information to be gathered which the attached questionnaires cover:

- organisational / management perspective
- data
- technical

This questionnaire has been designed in three separate parts and it is suggested that two people attend each interview (eg one person to ask the questions, the other to record the answers and seek further clarification if necessary etc).

Date interview held: _____

Name of Organisation: _____

Organisational / Management Information Gathering

The type of information to be gained from this interview is big picture, organisational overview, history and purpose of database etc.

Management / Organisational Information:

1 Name of interviewee: _____

2 Position held in organisation: _____

3 What is the prime purpose of the database? _____

_____

_____

4 How did this database come about?

_____

_____

_____

5 How has the database been developed? (in-house, bespoke, off-the-shelf)

_____

_____

6 What sector of the industry does the database cover *(dairy, sheep, beef etc)?*

_____

7 What percentage (approx) of the industry is that? *(meaning % of regional sector or national sector, e.g. 95% of all beef cattle)*

_____

_____

Process Questions

8 Where does the data (information) come from (who are the suppliers of the data)?

_____

_____

_____

9 How often do you receive this information? (*daily, weekly, monthly etc*)

_____

_____

10 In what format or how is this information received? (*mail, email, report form etc*)

_____

_____

11 How is this information used? (*commercially – reporting – decision making – other*)

_____

_____

12 How long do you hold the information for or do you have an archiving system in place?

_____

_____

13 If archiving system in place, what is it based on?

_____

_____

14 What is the current level of the documentation?

_____

_____

Connectivity

15 What type of access to your database? _____

_____

_____

_____

16 What type/method of file upload/download do you use?

_____

_____

17 What types of external output do you use? *(reports, web based, other)*

_____

_____

18 Do you connect to any other database, and if so, for what purpose?

_____

_____

Development Team

19 Do you have an in-house development team? _____

If yes, what size? _____

20 Who does the maintenance of the database? _____

21 What about backups, who does and how often? _____

_____

Future Developments

22 Do you have any future development plans for the database? Yes/No

23 Would you like to tell us about them? _____

_____

_____

_____

24 Any other information or comments you may like to add?

_____

_____

Appendix B Technical Questionnaire

Data / Technical Information

Database Information

The following are meta-level questions relating to the data sets and actual data held by the (database) information system. These questions should be addressed to a member of the IT team. There is some duplication of questions from the section above.

Name of interviewee: _____

Position held in organisation:_____

---

1. What entities are covered by the schema? _____

   _____

   _____

   _____

2. How are they defined?
   a) by herd _____
   b) by flock _____
   c) by farm _____
   d) other _____

3. With respect to farms, do you keep information on:
   a) location details _____
   b) farm inputs such as feed supplements _____
   c) certification such as Organic? _____

4. How do you uniquely identify:
   a) farms _____
   b) herds/mobs/flocks _____
   c) individual animals _____

5. With respect to individual livestock do you keep information on:
   a) breed / species _____
   b) date of birth _____
   c) physical tag _____
   d) electronic tag _____
   e) parentage _____
   f) pedigree/stud records _____
   g) AI *(artificial insemination)* _____
   h) ET *(embryo transfer)* _____
   i) DNA markers _____
   j) Animal health treatment? _____
   k) Others _____

6. Are there any alternative ID systems such as flock tags, electronic IDs? How can animals be re-identified on loss of tags?
   _____
   _____
   _____

7. Is the status of individual animals tracked? Eg
   a) sold alive _____
   b) sold alive for live trade _____
   c) dead on farm _____
   d) killed on farm _____
   e) killed at works? _____

8. Do you keep information on animal movements? What level of detail is recorded:
   a) sales and purchases _____
   b) farm block to farm block _____
   c) trucking of mobs in combination _____
   d) time at saleyards _____
   e) combinations of mobs at saleyards? _____

9. Where does the data come from *(who are the suppliers of the data*)?

_____

_____

_____

10. How often do you receive this information? (*daily, weekly, monthly etc*) _____

_____

11. In what format or how is this information received? (*mail, email, report form etc*)

_____

_____

12. How is this information used? (*commercially – reporting – decision making – other*)

_____

_____

13. What archiving systems do you have in place?

_____

_____

14. What processes or tools are used for data validation?

_____

_____

_____

15. Any other comments?

_____

_____

Technical

1. What is the size of the IT development team? What are their roles and responsibilities?

   _____

   _____

2. What are the hardware specifications and operating system currently being used by the information system?

   _____

   _____

3. What database management system are you using?

   _____

   _____

4. Are you using bespoke or commercial off-the-shelf information systems?

   _____

   _____

5. Are they developed in-house or outsourced?

   _____

   _____

6. What is the development platform?

   _____

   _____

7. Do you use any peripheral systems or platforms?

   _____

   _____

8. Does the database have ongoing maintenance and backup systems in place?

_____

_____

9. What is the current level of the documentation?

_____

_____

10. What type of system connectivity has been implemented?
    a) Web _____
    b) Web services _____
    c) EDI _____
    d) file upload/download using FTP or http protocols.
    _____
    _____
    e) database connectivity to ancillary or subsidiary databases?
    _____
    _____

11. What type of data extraction is currently undertaken? What is your capability for future potential data extraction requirements?

_____

_____

12. Do you have any future development plans for the database? Yes/No

12. Would you like to tell us about them? _____

_____

_____

13. Any other comments: _____

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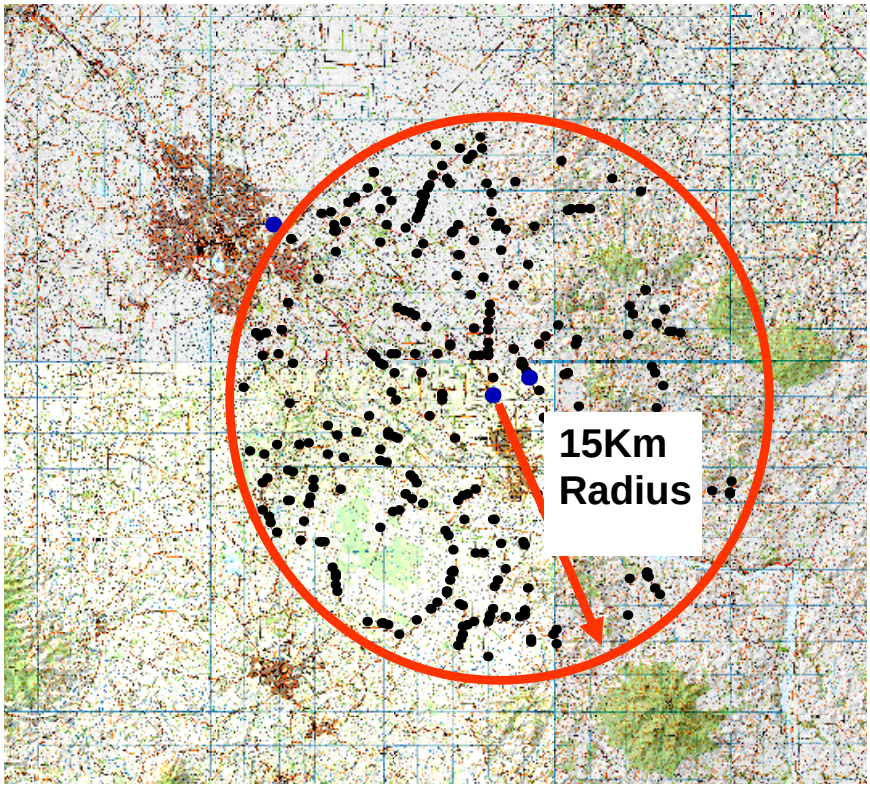
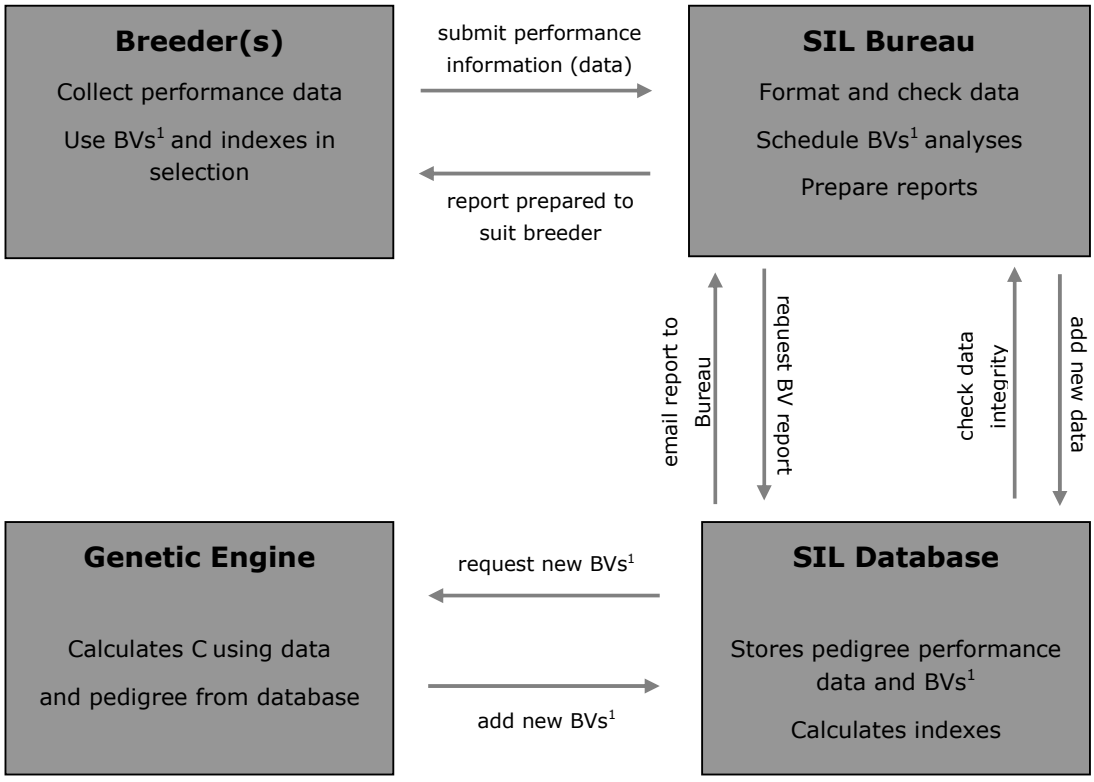
Appendix C Sample LIC Traceability Report

An example of one type of traceability report is displayed below. This report shows the supplier number, name and farm address details. (Any radius size can be selected and farms are identified as black dots.)



PTPT	Supplier	First Name	Last Name	Phone	Address
DFVT	72804		Fonterra - Bruntwood Farm		Private Bag 885
DGNB	72851	[redacted]	[redacted]	07 823[redacted]	State Highway 1
FQCB	72857	[redacted]	[redacted]	07 823[redacted]	113 Discombe R
GCGJ	72813	[redacted]	[redacted]	07 827[redacted]	129 Forrest Roa
GWLT	72849	[redacted]	[redacted]	07 823[redacted]	151 Pickering R
NTY	72812	[redacted]	[redacted]	07 827[redacted]	163 Forrest Roa
JYPJ	72811	[redacted]	[redacted]	07 823[redacted]	168 Forrest Roa
VLH	72803	[redacted]	[redacted]	07 827[redacted]	272 Bruntwood
HPTT	72847		[redacted]	07 827[redacted]	Private Bag 884
VKK	72802		[redacted]	07 827[redacted]	Mary Church Rd
WMH	72796		[redacted]		78 Church Road
LQFV	72801	[redacted]	[redacted]	07 823[redacted]	443 Victoria Roa
JVVR	72799	[redacted]	[redacted]	07 823[redacted]	443 Victoria Roa
JTW	72792		[redacted]	07 827[redacted]	382 Bellevue Rd
LNV	72791		[redacted]	07 827[redacted]	542 Victoria Roa
KFX	72773	[redacted]	[redacted]	07 827[redacted]	542 Victoria Roa
PYQ	72790		[redacted]	07 827[redacted]	470 Victoria Roa
DFRB	72817		[redacted]		Private Bag 885
HMTD	72848		[redacted]	07 856[redacted]	184 Lee Martin
GHQX	72806	[redacted]	[redacted]	07 827[redacted]	542 Victoria Roa
LJQF	72821		[redacted]	07 827[redacted]	567 Fencourt R
HTRB	72823	[redacted]	[redacted]	07 827[redacted]	490 Fencourt R
JKDP	72831	[redacted]	[redacted]	07 823[redacted]	446 Fencourt R
QLR	0	[redacted]	[redacted]	07 827[redacted]	254 Maungakaw
DFXB	72835	[redacted]	[redacted]	07 827[redacted]	429 Fencourt
HTFT	72837	[redacted]	[redacted]	07 823[redacted]	408 Fencourt R
FQW	72824	[redacted]	[redacted]	07 827[redacted]	Fencourt
HCWG	72834		Fonterra - Buxton Farm		Private Bag 885
JRHH	72833	[redacted]	[redacted]	07 827[redacted]	272 Fencourt R
JBBY	0		[redacted]	07 823[redacted]	131 St Kilda Ro
LLBD	72825		[redacted]	07 827[redacted]	P O Box 458
DVKC	72935	[redacted]	[redacted]	07 823[redacted]	4-210 Aspin Ro
DFPR	72845	[redacted]	[redacted]	07 827[redacted]	272 Fencourt R

Appendix D SIL System Overview



BV[1] – breeding value, a measure of genetic merit