COLLECTION **MÉTHODES & OUTILS**

Electronic identification in the sheep sector

Final report on the pilot projects 2008-2010

INSTITUT DE L'ELEVAGE

identification ovine et caprine

INSTITUT DE L'ELEVAGE

Collection
Méthodes et Outils

Document rédigé par :
Jacques Holtz (Institut de l'Élevage),
Laureline Mercier (Institut de l'Élevage),
Sébastien Duroy (Institut de l'Élevage),
Adrien Debroux (Institut de l'Élevage).

Conception graphique :
Bêta Pictoris

Mise en page, illustrations :
Céline Bouscarle

Table of Contents

1 INTRODUCTION TO THE PROJECT

1.1 Context and background behind the initiative

The Council Regulation EC No. 21/2004 on establishing a system for identifying and registering ovine and caprine animals, in application since July 2005, provided for the compulsory implementation of electronic identification in 2008. The deadline for implementing the system was eventually put back to 1st January 2010.

Before making this implementation compulsory, the reliability of the system had to be tested. Consequently, a number of projects have been carried out in France and the rest of Europe since 1998.

1.1.1. The 1st European project: IDEA (1998-2001)

The IDEA project (*Identification Electronique des Animaux* or electronic identification of animals) was implemented by Europe and set out to establish whether or not the tool was developed enough for it to be possible - at a later stage - to put it into general use for individually identifying all animals in Europe and improve:

- the management and tracking of premium farming schemes in the common agricultural policy,
- the tracking of animals in order to enable suitable animal hygiene surveillance to be implemented and the improvement of initiatives designed to combat animal diseases, the long-term aim being to eradicate them,
- the efficiency of tracking animal trade within the EU.

With 6 nations (France, Germany, Italy, the Netherlands, Portugal and Spain) and 800,000 animals involved in the trial, the project was designed to confirm the technical feasibility, in real-life conditions, of using transponders (boluses, tags, implants), the means that could be used to retrieve information from them, reading modes, failure rates, the organisational structure imposed by technical requirements, as well as transmission of the information flow.

In 2001, according to the Commission, the IDEA project clearly demonstrated that a "substantial improvement in traceability can be achieved by electronically identifying livestock, and that there is no technical reason why it could not be used with cattle, buffaloes, sheep and goats". The results indicated that these systems could be applied to a very broad range of animal species and in very diverse conditions: intensive and extensive rearing, transport both within and outside Europe, different slaughtering techniques, and environmental extremes in the north and south of the EU.

1.1.2. French pilot projects (2004 to 2008)

In the wake of these results, the first project was implemented in France in 2005. It relied on support from the public authorities, and on the will of professionals to be involved in implementing this electronic identification system and to defend - at European level - the technical options that were most suitable for use on farms, and throughout the rest of the sector, in France.

Its main aims were:

- feasibility studies for the uses of electronic identification throughout the sheep sector, from the farm to the abattoir (herd management, performance checks, transport, batching centre, market, abattoir, etc.),
- ensuring that different users throughout the sector adopted the technology,
- implementation in real-life conditions,
- understanding the conditions and establishing the costs associated with using electronic identification, information which decision-makers could use in order to be able to act with full knowledge of all the facts.

In order to do this, 6 pilot projects were launched in dairy and suckling production zones. At the time, they involved:

- 110 farms, 5 performance supervision bodies (dairy and suckling),
- 7 batching centres and transporters,
- 1 live market,
- 10 abattoirs.

The project involved ear-tagging 150,000 ewes and lambs, providing 100 portable readers and 50 fixed readers at all levels, supervision at each area by a regional manager, with coordination at national level provided by the Institut de l'Elevage.

Although the pilot projects carried out in 2004-2005 achieved most of the objectives they set for themselves at the outset, they also revealed several difficulties:

- **the significant number of output formats used by the readers, meaning that each piece of software has to be specifically developed for each manufacturer's output format.**
  The solution put forward was therefore to establish a standard for reader output formats. A first version of this standard was validated in September 2006.
- **the need to manage live animal read failures as they move through a working chute fitted with a fixed reader. This involved applications in batching centres and abattoir sheepfolds in particular, as well as on a few farms.**
  In September 2006, the first solutions were put forward by the manufacturers. The need to ensure that these solutions were also able to sort animals on criteria other than read failures delayed the first concrete initiatives until April 2007.
- **The problems, when collecting animals from farms, associated with reading tags as the animals climbed up into a lorry by fitting the bridge or loading ramp with a fixed reader. The tests carried out did not give satisfactory results.**

Given the uncertainty surrounding the date at which electronic identification would become compulsory, a transitional period then followed (2006 to 2008) during which the supply of tags to farmers who had been using them since 2005 was maintained, reading devices were kept in working order and new reading equipment was acquired for testing in order to factor in management of read failures in different situations.
Most of this equipment comprised a fixed reader and a working chute for stopping the animals, as well as automated sorting doors linked, in some cases, to a weighing system. In order to operate the automatic equipment, these systems also require a software management application.

A number of devices, all prototypes, were acquired during this period:

- on farms:
  - weighing/sorting system (LG Produkter) at the CIIRPO's experimental farm in Le Mourier (87),
  - sorting system (Allflex/EID Trace) on a trailer at the experimental farm in Carmejane (04),
  - weighing/sorting system (Gallagher/EID Trace) in a transportable Maréchalle pen at the farming college in Charolles (71),
  - sorting system (Asserva) on a dairy farm in the Aveyron (12).
- At batching centres:
  - sorting system (Albouy/Allflex/EID Trace) at the GEBRO and at UNICOR (12) + restrainer (Cailhol),
  - weighing/sorting system (Allflex/EID Trace) on a Prattley pen in COBEVIM (52).

Reading tests continued during this period, with reduced management at regional level owing to the absence of funding allocated to this task.

A certain number of conclusions were drawn from the 2005-2008 pilot projects:

- **a number of applications are possible on farms beyond traceability for hygiene purposes: technical management of cattle, performance checks, etc.**
- **operators working downstream in the sector are interested in the system, but would prefer it if all animals were electronically identified, to avoid having to manage a dual system (manual/electronic);**
- **there are still a number of important points that need to be improved: reading with certain fixed readers (pens, etc.), interoperability between different systems.**

1.2 The 2008-2010 “electronic sheep identification" pre-deployment project

This is in line with the future European and French regulations which will require that:

- all animals born after 1st July 2010 be identified with an electronic marker,
- all animals born before this date be electronically tagged before 1st July 2013,
- all individual movements of animals, starting on 1st July 2012, be recorded in a central database.

In this context, and as an extension of the tests carried out in 2005 to 2008, (the pilot projects), the DGAL wanted to ensure that all of the conditions for a wide-scale deployment of the system had been met, assessing, in real life, the impact of an initial widening of the scope before extending the system throughout the EU.

In order to do this, more public funding was set aside to finance investments for equipment (tags, readers), as well as for managing/coordinating the initiative, on the basis of the system introduced in 2005-2008. Once again, the geographical area was split into 6 zones, with technical management and coordination provided at regional level by zone managers, and technical coordination provided at national level by the Institut de l’Elevage.

However, no financing has been put aside for the “professional use” aspects of electronic identification (software development, IT gateways, etc.) in this project.

1.2.1 Aims and objectives

When they were relaunched, 4 priority objectives were set for the electronic sheep identification pre-deployment projects:

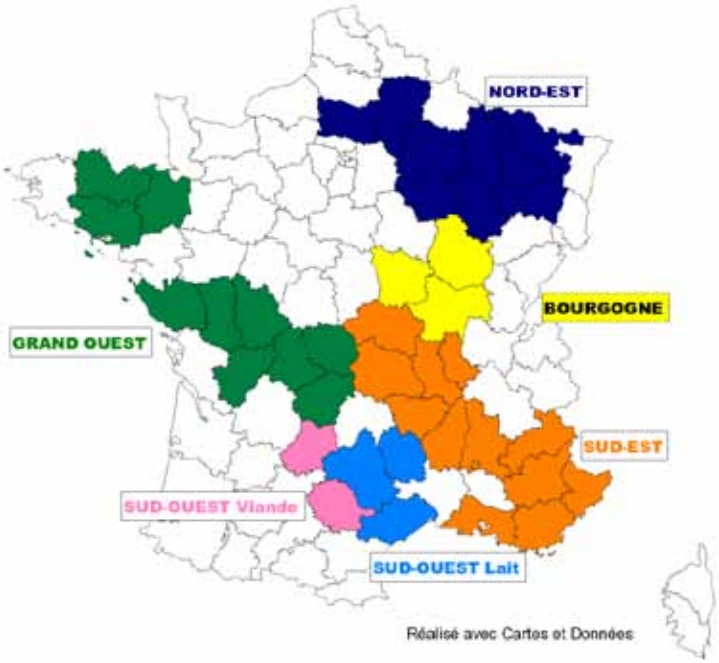
1. Increase the number of farmers involved, by increasing the variety of populations and by involving farmers who make less use of the applications, in order to win the support of farmers and to tackle the issues to which the introduction of electronic identification would give rise upstream. This also made it possible to increase the number of animals that were electronically identified, and so increase the options for reading them at downstream facilities, such as collection centres and abattoirs.
2. Test electronic reading at all levels throughout the sector with the prospect of individual notifications, taking new devices which are now available on the market into account, as well as those that have been available since 2005.
3. Implement powerful long-term campaigns to raise people's awareness of the introduction of compulsory regulations, using national trade fairs (such as Tech’Ovin and the Sommet de l’élevage), as well as regional fairs and locally-held information meetings.
4. Look in greater detail at how animals can be read using fixed readers, with the focus on limiting - and managing - the numbers of read failures.

1.2.2 Regional projects and partners

1. **Burgundy**, run by the Saône et Loire EDE (regional livestock centre.
   - *Electronic tag reading and individual notification tests on farms.*
   - *Electronic tag reading and individual notification tests during collection operations carried out by COOPROVOSEL.*
   - *Reading and individual notification tests at COOPROVOSEL batching centres.*
   - *Communications campaigns about electronic identification: its use within the context of implementing individual traceability systems and professional applications.*
2. **North-East** (Lorraine, Champagne-Ardennes and Picardie areas), run by the Meurthe-et-Moselle Chamber of Agriculture.
   - *Electronic tag reading and individual notification tests on farms.*
   - *Electronic tag reading and individual notification tests during collection operations carried out by producer organisations such as BNE and COBEVIM.*
   - *Reading and individual notification tests at the COBEVIM batching centre.*
   - *Electronic tag reading and individual notification tests at abattoirs (Laon).*
3. **West** (Poitou-Charente, Limousin, Loire, Britanny regions), run by the Centre-west EIG and the Limousin region sheep farmers association.
   - *Electronic tag reading and individual notification tests on farms.*
   - *Electronic tag reading and individual notification tests during collection operations carried out by producer organisations (CAVEB, CCBE).*
   - *Reading and individual notification tests at batching centres (CCBE).*
   - *Electronic tag reading and individual notification tests at abattoirs (Bellac, Le Vigeant, Thouars, Bessines).*
   - *Reading and individual notification tests at markets (Parthenay).*
4. **South-west *"sheep meat"*** (Lot and Tarn regions), run by the Lot EDE (regional livestock centre).
   - *Electronic tag reading and individual notification tests on farms.*
   - *Electronic tag reading and individual notification tests during collection operations carried out by producer organisations (OVILOT).*
   - *Electronic tag reading and individual notification tests at abattoirs (Gramat).*
5. **South-west *"sheep milk"*** (Aveyron, Lozère and Hérault regions), run by UNOTEC.
   - *Electronic tag reading and individual notification tests on farms.*
   - *Electronic tag reading and individual notification tests during collection operations carried out by producer organisations (GEBRO, UNICOR).*
   - *Reading and individual notification tests at batching centres (UNICOR, GEBRO).*
6. **South-east** (Rhône-Alpes, Auvergne and Provence Alpes Côte d'Azur region) co-run by Rhône-Alp'Elevage and the *Maison Régionale des Eleveurs PACA* - the PACA farmers' regional centre.
   - *Electronic tag reading and individual notification tests on farms.*
   - *Reading and individual notification tests at sheep farm abattoirs (Sisteron).*
   - *Electronic tag reading and individual notification tests at abattoirs (Sisteron, Grillon).*
   - *Electronic tag reading and individual notification tests for transhumant herds.*

THE PROJECTS - SOME FIGURES

- 40 *départements*, and the associated sheep identification project managers (EdE/GDS)
- 330 breeders and 370,000 tagged animals (including 150,000 ewes and lambs which have already been identified)
- 6 batching centres and collection centres,
  CAVEB (79), CCBE (23), UNICOR (12), GEBRO (12), COBEVIM (52), COOPROVOSEL (71)
- 1 market
  Parthenay (79)
- 7 abattoirs
  Sisteron (04), Le Vigeant (86), Thouars (79), Bessines (87), Bellac (87), Laon (02), Grillon (84), Gramat (46)

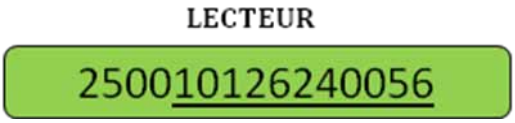


- 2 Performance Supervision bodies (54 and 81)

2 THE KEY ASPECTS OF ELECTRONIC IDENTIFICATION (RFID)

2.1 General principle

Electronic identification is a remote identification technology that does not involve contact between the identifier (the animal being identified) and a reading device. The identifier contains an electronic chip. The reader uses radio waves to communicate with the identifier.



The electronic chip only contains the animal's national number:

- the country code is represented by 3 digits (250 for France),
- the animal's national number is encrypted in 12 digits (to the far right of the sequence, preceded by a zero for 11-digit national numbers for French sheep). This is the same number as the one marked on the tag (Cf ISO 11784 standard in § 2.4.4).

2.2 The identifier

2.2.1 The ear tag

The official electronic identifier used in France for sheep is a tag, the female section of which is in the form of a button, containing a transponder.

The electronic identifier can also be a pastern ring (only authorised for goats), an insert or a ruminal bolus. Although inserts and ruminal boluses are authorised by European regulations, they are not allowed in France. So although boluses may not be used as official identifiers in France, French farmers sometimes encounter them when trading animals with other countries in the European Union.

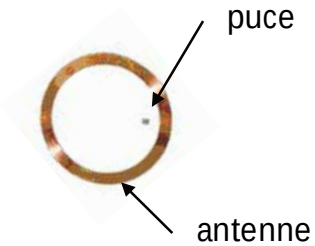
2.2.2 The transponder (or radiofrequency label)

This is the electronic component which contains information and which communicates with the reader.

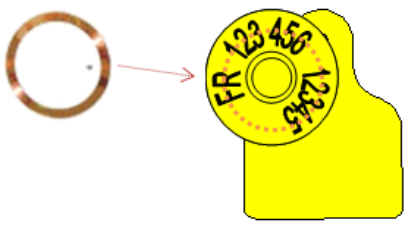
A transponder is made up of:

- an electronic chip, i.e. a silicon microcircuit with a surface area of approximately 1 mm² which contains the digital information,
- a circular antenna approximately 3 cm in diameter, made of coiled copper wire, for communicating with the reader.

Transponder



Location in the tag



The transponder is moulded into the tag

2.3 The Readers

Like the identifier, the reader also integrates an antenna (made of coiled copper wire) which enables communication by radio waves with the electronic identifier.

The reader emits a magnetic field. When the identifier enters this field, it absorbs energy through its antenna and sends information back to the reader. The reader then decodes and saves and/or transmits it.

There are two types of reader: fixed readers and portable readers.

2.3.1 Fixed readers

The tag is read when the animal comes close to the reader's antenna. Fixed readers can be installed in sheep crushes, in chutes or milking parlours, or integrated into automatic equipment or slaughter lines, etc.

There are several types of fixed reader:

· fixed panel:

The panels are installed on the walls of sheep crushes or chutes. Panels can be installed facing each other in a chute in order to strengthen the reading field.
In the existing ranges, there are different panel sizes available, ranging from approximately 30 cm x 30 cm, to 160 cm x 60 cm.

Some panels are hollow, designed as simple frames, through which operators can pass their arms and handle the animals if necessary.

· gateway:

With this type of reader, the animal passes through the antenna. The magnetic field emitted by the antenna extends over several dozen centimetres in front of and behind the gateway. Tags can be read anywhere within this zone.

The antennae for gateway readers can be made-to-measure.

· transportable panel:

Unlike fixed panels and gateways, this type of device has:

- a battery, enabling it to operate autonomously for several hours,
- an integrated memory for storing the numbers it reads for later use.

Its transportability means that it can be shared between different users, and acquire separate sets of data.

· fixed reader with portable antenna:

Unlike fixed panels and gateways, this type of device has:

- a fixed reading box,
- a mobile antenna connected to the box via a cable connection, enabling tags to be read over a wider area.

This type of reader can be used in a way that is very similar to the way in which a mobile reader is used; the user has to move antenna towards the animal.

2.3.2 Portable readers

The user must move the reader close to the tag in order to read, save and/or transfer the number.

There are different types of portable reader:

· stick:

The functionality of stick readers is very simple. They can be used to read, save and transfer numbers.

· box:

This type of reader comes with a keypad which can be used to add additional information to numbers as they are read.
This feature can be used to create batches when reading an animal's number, for example.
Some models include a cane-type extension for slightly increasing the read range.

Both stick and box readers have integrated memories for transferring the numbers read so that they can be used later on. They can be transferred via a cable, or wirelessly (Bluetooth®).

· "all-in-one":

"All-in-one" readers combine the functions of a pocket computer (PDA) and an electronic reader.
Numbers can be easily transferred using this type of reader - the same device is used to read the number and then make use of it via the integrated software.
Some brands offer these devices with integrated barcode readers. This makes it possible - in insemination centres, for example - to cross-reference data read from electronic tags and semen dose labels.

2.4 Technical characteristics

The following technical characteristics are used for officially identifying sheep:

2.4.1 Low frequency radio waves (134.2 kHz)

These are not easily affected by the environment, and are suitable for use in a liquid environment (specifically, they can be used to read ruminal boluses through animals' abdomen walls). Read

distances, as well as data exchange speeds, are limited compared with those possible with higher frequency waves (HF, UHF).

2.4.2 Passive transponder

The identifier does not have its own power supply (no integrated battery). This gives it an unlimited lifespan, meaning that it is suitable for repeated identification operations over a long period of time (IPG). It requires the energy generated by the reader in order to operate the chip and transmit information.
The electronic tags only emit (low frequency) waves when they are within the magnetic field of a reader and are in communication with it.

2.4.3 OTP type encryption (one-time programmable)

The chip is permanently encrypted (operation which involves marking the animal's number into the chip) by the manufacturer when the tag is written to. Once the chip has been encoded, a fuse system is used to lock the chip into read-only mode so that it cannot be rewritten to. This ensures that the system is inviolable and that the numbers used are unique, with a strict identity between the number as it is graphically displayed on the tag and the number that is electronically encrypted into it.

2.4.4 Compliance with ISO 11784/11785 standards

The equipment's compliance with international standards ensures its compatibility with readers and transponders across France, Europe and the rest of the world. All transponders used are compliant with ISO 11784/11785 standards.
These standards do not provide for the management of anticollision (reading several tags at once); the animals have to be read one at a time.

- Information contained in a transponder:

The ISO 11784 standard specifies the type of information encrypted into a transponder. Information is stored in 64-bit format, with the last 48 bits giving the animal's number in encrypted form.

Information contenue dans le transpondeurs selon la norme ISO 11784

Bits	1	2 à 4	5 à 9	10 à 15	16	17 à 26	27 à 64
Description	domaine animal	compteur de remplacement de 0 à 7	information utilisateurs : code espèce pour EU	champs réservés	pages additionnelles	code pays ISO	n° national identification
Exemple en France	1	0	02 pour les bovins 04 pour les ovins-caprins	00	0	250	012345678912

· Transponder technologies:

The transponders can either use HDX (Half-Duplex) or FDX-B (Full-Duplex) technology. Both are recognised by the ISO standards mentioned above:

HDX

According to this standard, data is exchanged between the reader and the tag asynchronously:
while the reader is activated, the transponder stores enough energy so that it can power the chip. Once the reader ends its activation, the transponder sends its response (the identification number).

FDX

According to this standard, data is exchanged between the reader and the tag synchronously:
both the reader and the transponder operate at the same time. The reader activates the chip and the transponder responds continuously as long as the field is maintained.

Readers that are compliant with the ISO 11785 standard can read both HDX and FDX standard transponders. The technology used in the transporter is completely transparent for the user (cf. § 4.4)..

2.4.5 Read distances

Portable readers have an average read distance of approximately 15-50 cm, while fixed readers can read tags at around 50 cm.
This low-frequency technology may not be used to read the tag on an animal that is very far away (in the middle of a field, for example). Even if readers were to become more powerful in the future, the magnetic field they emit could not be used to individually identify an animal that was very far away.

These distances - of a few dozen centimetres - are an asset in certain applications. This is because the intensity of the magnetic field emitted by a reader decreases in proportion to its distance. Also, low-frequency waves are not subject to "rebound" phenomena which increase their dispersion. These two factors together ensure that the animal whose tag is read is the one closest to the reader and not one that is further away.

2.4.6 Conditions for tags being read successfully

· reading animals individually:

Low-frequency ISO electronic identification cannot be used to manage anticollision (the capacity to detect two identifiers simultaneously), and so the animals have to be read one at a time. In order to electronically identify animals properly, they need to be read individually using an appropriate penning system.

· ensuring that the animals move within range of the reader:

Once the farmer has made sure that the animals are read separately, they must ensure that their tags can be activated by the field emitted part by the reader. Penning is a way of making sure that the animals pass through the reader's range at a given moment.

2.5 Different usage modes

Electronic identification can be used in a number of different ways with a range of very varied applications. Some usage modes are more appropriate than others, depending on the place where the animals are kept, the business sector, how the work is structured and configured and the operator's preference.

2.5.1 Fixed reading / portable reading

When a portable reader is used, the animal is stationary (or roaming in a semi-extensive grazing system), and it is the operator who moves.

When a fixed reader is used, the operator remains at his workstation, and the animal is either stationary, or free to move around.

2.5.2 Static reading / dynamic reading

In some situations, operators are required to read the tag of a stationary animal; other situations are better suited to managing animals as they move.

The reading can be carried out statically, i.e. when the animal is stationary. In such cases, the animal is read using either a fixed or a portable reader.

They can be read dynamically, meaning while the animals are moving. In this situation, they can only be read using a fixed reader.

2.5.3 Using the data in real-time / later

In most cases, electronically reading a tag is a precursor to data being entered into an IT system, or saved, or displayed on a screen... or it activates a piece of automatic equipment, etc. In such cases, the data that has been gleaned from the electronic identification process is used instantaneously; the operation is carried out in real-time.

Electronic identification can also be used simply as a means of collecting numbers so that they can be used later on. The reader stores the numbers it reads in its internal memory so that they can be transferred subsequently. The data is then used later on.

2.6 Different connection modes

The way in which data is transferred between a reader and the peripheral device which makes use of it (currently PDA, Smartphone no doubt in the future, PC) is a fundamental aspect of how electronic identification operates.

2.6.1 Cable connection

Cable connections are for portable and fixed readers. In both cases, cable connections have been tried and tested, and are considered functional. With fixed readers, RS232 serial connections are mainly used because of their sturdy construction. With portable readers, USB connections are used.

2.6.2 Wireless Bluetooth® connection

The wireless Bluetooth® data transmission protocol is mainly used to transmit data acquired by a reader (fixed or portable) to a PDA or computer in real time.

Various tests have shown that configuring and using a Bluetooth® connection is complicated for an inexperienced user. As things stand, it could only be deployed on a wide scale if farmers were provided with a significant amount of technical support.

Reader manufacturers must therefore offer simple solutions that everyone can use.
One such solution is the “all-in-one” system, made up of a PDA with an integrated reader.

2.6.3 New technologies, such as GPRS, WiFi, etc.

GPRS, EDGE and 3G/3G+ are all mobile phone technologies which can be used to transfer data to remote databases. Their range can be from 10 to 30 km from a relay antenna. Their usage is contingent on network coverage.

Like smartphones, readers can integrate GPRS, EDGE or 3G/3G+ connectivity so they can communicate with centralised databases, without the need for intermediary synchronisation with a desktop PC.

3 SCENARIOS INVOLVING THE USE OF ELECTRONIC IDENTIFICATION

A number of different scenarios involving the use of electronic identification by bodies involved in sheep farming have been studied and assessed, and defined according to the context and specific aims given to the pre-deployment projects. These scenarios are assessed in this report as a series of information sheets.

Context

The future requirement (2012) to provide individual notification of all movements of animals, with situations that are very different today, in terms of:

- category of animals managed (size, age, weight, gender, etc.),
- daily numbers of batches processed,
- equipment in use in buildings and their layout - buildings the majority of which were not designed for live reading of animals on an individual basis,
- the way in which work is structured,
- operators' quality and commercial traceability policy.

Objectives

The requirement - for the purposes of reliable traceability - to retrieve 100% of all animals' identification numbers when they need to be read (entry into or exit from a detention area).

And the requirement to make use of the data read in order to:

- comply with future regulations (individual notification),
- to secure a return on investment (equipment, modifications to buildings, software, etc.) for the operator.

Conditions of implementation

The need - in order to integrate individual reading - to take account of a structure that is currently established on the basis of management by batches (not individual reading):

- in terms of equipment, human resources and economic factors,
- in terms of how the information system is structured,
- from the perspective of the animals' behaviour: most of the young animals arriving in a collection centre for slaughter are entering into a penning and reading system for the first time. Unlike other situations on farms, animals for slaughter don't have the opportunity to get accustomed to the system.

The need to integrate the reader/reading device into a building which - in many cases - will need to have its layout modified for reasons of efficiency and operational speed.

Working methods used in the sector

The way in which pre-deployment initiatives were implemented was divided into 5 successive phases. This was necessary in order to obtain optimal assessment conditions:

- The first phase involved tagging all animals in the herds in order to provide the various project operations with electronically tagged animals.
- At the same time, initiatives that involved equipment manufacturers (electronic readers, penning equipment, etc.) working closely alongside the managers of facilities downstream of the sheep sector were carried out. These enabled feasibility studies to be carried out into the integration of reading systems into buildings and into the working habits of the staff working at these facilities.
- After the impact study phase came a phase during which the equipment that had been chosen was installed. More often than not, these were prototypes which had to be adapted and fine-tuned many times.
- In order to validate these modifications and assess the functionality of these devices, a small-scale test phase involving a small number of animals was required.
- Finally, there was a routine use phase based on the number of electronically tagged animals at the facility. It is this phase which forms the basis of all evaluation and assessments of how this equipment might be used in the future, and is the starting point for any avenues for improvements.

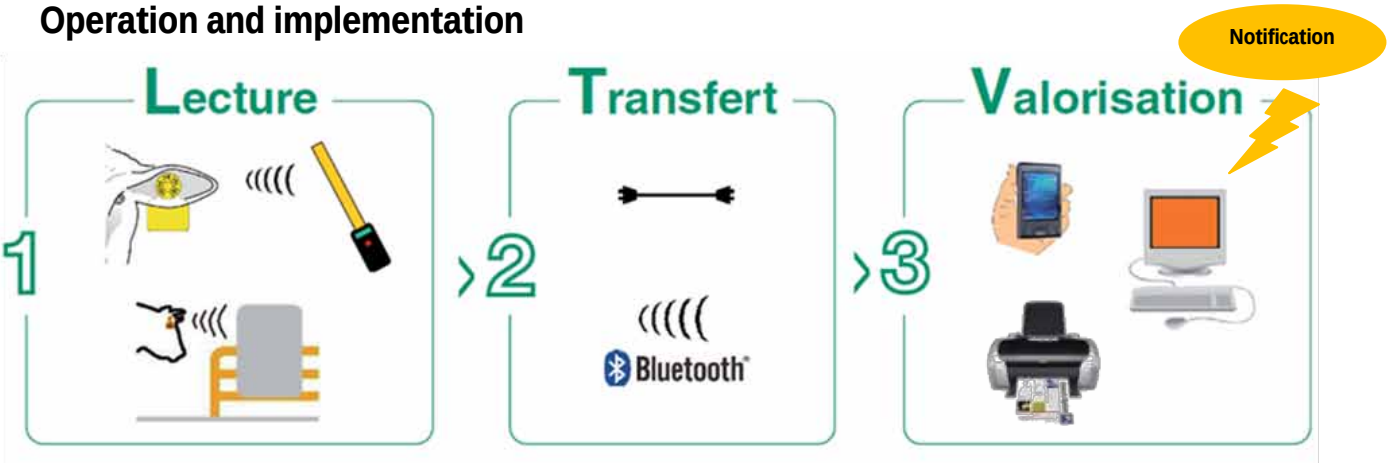
In addition to these 5 phases, depending on the facilities' willingness to commit, an additional phase was instituted when managers of organisations had invested resources in order to integrate the reading devices into the company's IT system.

The rest of this section of the document is a series of information sheets.

ELECTRONIC READING ON A FARM EQUIPPED WITH FLOCK MANAGEMENT SOFTWARE

Users: Farmers who want to make optimum use of being able to read their animals' RFID tags when carrying out various operations at farms, combining electronic reading and flock management software.

Operation and implementation



1. The number can be read automatically using a portable or fixed reader.
2. The number is then transmitted in real time (PDA/Smartphone) or later on (PC).
3. The data acquired is used by flock management software for various events types (notifications, health events, etc.).

Three types of use have been tested:

	Equipment	Sheep crush	Use
1	PORTABLE reader + PDA	Animals penned	REAL time
2	"All-in-one" PDA	Animals penned	REAL time
3	FIXED reader + PDA	Moving animal	REAL time

Conditions of use

- It is essential that the animals be PENNED for them to be read: stationary in a chute, in a feeding rack, tightly packed in a box (the animals that have been READ NEED TO BE MARKED in order to distinguish them from those which are waiting to be read).
- For use with flock management software, APPLICATIONS NEED TO BE INSTALLED and correctly CONFIGURED in order to retrieve the numbers, with support from the software publisher.
- For a Bluetooth® connection with a PDA running the farmer's software: make sure that the software is COMPATIBLE with the reader that has been selected.

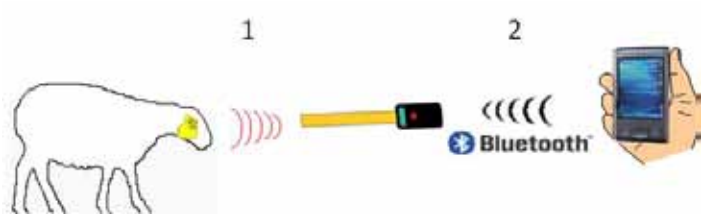
Conditions of deployment

- The farmer must be familiar with and be able to use the flock management software that he will use with electronic identification, before investing in reading equipment.
- Whatever reading equipment is purchased, after sales service and a maintenance contract must be secured, if possible for both the reading equipment and the device that makes use of the data (reader + PDA).

Tested flock management software

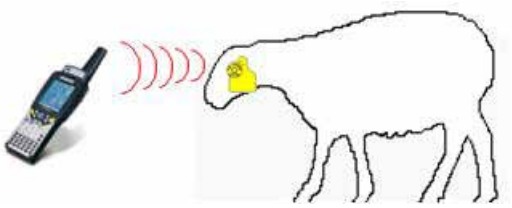
- OVITEL software (AGRALOG EIG)
- ISAOVIN software (ISAGRI)
- OVIMAXI, OVIMINI software (SOFTMOUV)
- CBI software (Roquefort confederation)
- VENUS software (UNOTEC)
- Est Elevage software (Pro6tem)

See assessments on the following pages.

1.1 - PORTABLE reader + PDA	Stationary animal Use in REAL TIME
Implementation and operation	 The portable reader is connected (wirelessly) to the pocket computer (PDA) on which the flock management software is installed. **1.** The numbers are read by the portable reader, **2.** and then transmitted in real time to the software which stores and processes them.
Equipment	Portable reader (€600-€1000), PDA (€250-€400)
ADVANTAGES	J RELIABLE reading, no data entry errors. J Information read can be USED in real time.
DISADVANTAGES	L HAVING TO SET UP THE BLUETOOTH® CONNECTION AND MAINTAING IT THEREAFTER: before using the portable reader for the first time, the connection between the reader and the PDA has to be set up. The waiting phases during an animal read operation, or the times when the PDA is put down can lead to the wireless Bluetooth® connection going into hibernation. When this happens, the operator needs to know how to re-establish it. L BULK: both the operator's hands are full with the portable reader and the pocket computer (PDA). (It should be noted that solutions currently exist which involve mounting the PDA onto the reader so as to free up one hand).
General advantages	The fact that the solution involves equipment that many farmers are already accustomed to using (PDA), and that it enables information to be used in real time mean that it can easily be adopted. Its limitations stem from its bulk (two devices = neither hand is free) and the problems associated with the instability of sending information over a Bluetooth® connection.

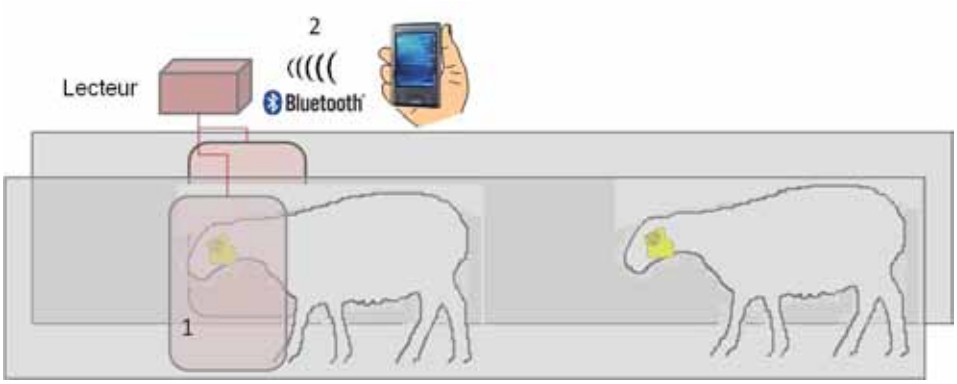
Stick type mobile reader connected to a PDA running a cattle management application via a Bluetooth® connection. Platform carries the PDA fixed to the reader.

Collar fixed to a chute so a stick type mobile reader can be used in a fixed configuration (cattle crush).

1.2 - "All-in-one" reader	Stationary animal Use in REAL TIME
Implementation and operation	 The reader and pocket computer (PDA) are integrated into a single device. The numbers read are immediately sent to the software application which stores and uses them.
Equipment	"All-in-one" PDA (€1000).
ADVANTAGES	J RELIABLE reading, no data entry errors. J TRANSFER, given that the reader is integrated into the PDA, there is no uncertainty over whether or not the data read is transferred to the software application (no Bluetooth® connection problems).
DISADVANTAGES	L BULKY: because of the device's size, it is difficult to carry it around all the time. L Read distance shorter than other stick type readers.
General advantages	The fact that both devices are integrated together, thus avoiding any data transmission problems, makes this an attractive solution. The problem is still the bulkiness of equipment (weight + volume) and the difficulties involved in installing certain flock management applications.

Using an "all-in-one" type reader on a sheep farm.

Once a number has been read electronically, the information associated with this number can be read using the cattle management software installed on the all-in-one reader.

1.3 - FIXED reader + PDA	Moving animal Use in REAL TIME
Implementation and operation	 The fixed reader is installed on the wall of a chute or sheep crush (left open) and connected (wirelessly) to the PDA on which the flock management software is installed: **1.** the numbers are read by the fixed reader as the animals pass by and, **2.** are then transmitted in real time to the software on the PDA.
Equipment	Fixed reader (€2000 to €2500), PDA (€250 to €400), chute or pen.
ADVANTAGES	J RELIABLE reading, no data entry errors. J REDUCED BULK, the operator only needs to have one device in his hand.
DISADVANTAGES	L HAVING TO SET UP THE BLUETOOTH® CONNECTION AND ITS STABILITY THEREAFTER: Bluetooth® connections are not always stable, and if they drop, the work is interrupted and so the operator needs to know how to re-establish them. L The need to have a portable reader as well for certain individual operations. L The system does not manage read failures directly - an additional structure or system is required (stop/sort door, the operator located in particular place, etc.).
General advantages	Using a fixed reader as part of this solution avoids the user having to carry around bulky equipment. In conditions in which animal flows are properly managed, this solution is faster than the one which involves using a mobile reader for operations on large volumes of animals (batch exit or entry, etc.). However, it is not suitable for certain more individualised operations (registering farrowing, prophylactic treatment, etc.). The other limitations associated with this type of solution are the high cost of fixed reading equipment and the limited ease with which information can be transmitted via a Bluetooth® connection. A fixed reader is therefore a device that can be used alongside a portable reading system, but which may not be used as a replacement for it.

ELECTRONIC READING ON A FARM WITHOUT FLOCK MANAGEMENT SOFTWARE

Targets users: Farmers who do not currently use flock management software for their farming activities and who are interested in using electronic RFID identification on their animals with minimum investment (just the cost of the reader).

Operation and implementation

Three types of use have been tested:

	Equipment	Use
1	PORTABLE reader + notebook	REAL time
2	PORTABLE reader + printer	REAL time
3	PORTABLE reader + PC	DEFERRED

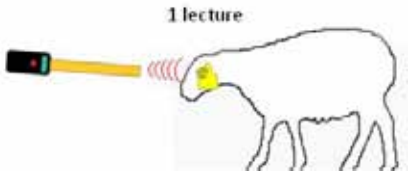
Conditions of use

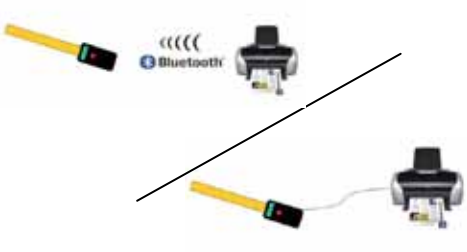
- It is essential that the animals be PENNED for them to be read: stationary in a chute, in a feeding rack, tightly packed in a box (the animals that have been READ NEED TO BE MARKED in order to distinguish them from those which are waiting to be read).
- For use on a PC: INSTALLATION OF APPLICATIONS with the support of the manufacturer.
- For a direct connection to a printer: the printer and the reader have to be specially adapted to enable them to be used together.

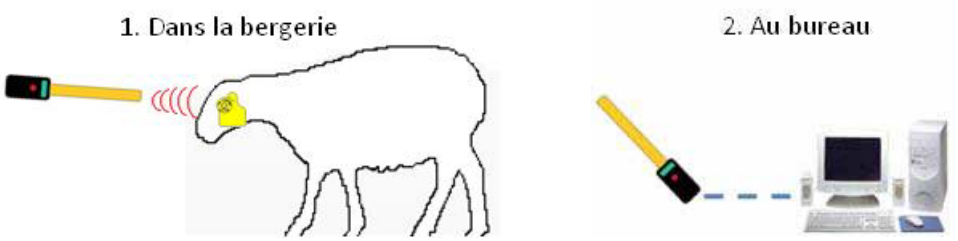
Conditions of deployment

- Whatever reading equipment is purchased, after sales service and a maintenance contract must be secured.
- A means of processing and making use of the information gathered is required.

See assessments on the following pages.

2.1 - PORTABLE reader + Notebook	Stationary animal Use in REAL TIME
Implementation and operation	  **1.** the animal's electronic tag is read. **2.** the number displayed on the reader screen is copied into the notebook and the farmer then adds any additional information.
Equipment	Portable reader + notebook
ADVANTAGES	J Can be USED for all operations.
DISADVANTAGES	L Electronic reading only has LIMITED USE. L POSSIBILITY OF ERRORS WHEN COPYING DATA ACROSS. L BULKY: reader + notebook. L COST OF THE READER for the limited use which is made of it.
There are reader models available which are completely dedicated to simply displaying numbers (and which do not send information to peripheral devices). These are much less expensive than the ones used for these projects. System without any major benefits.	

2.2 - PORTABLE reader + Printer	Stationary animal Use in REAL TIME
Implementation and operation	**1.** animal tags are read. **2.** a list is printed out 
Equipment	Portable reader + adapted printer.
ADVANTAGES	J RELIABLE reading, no data entry errors. J EASY TO USE. J The list of animals read is PRINTED OUT IMMEDIATELY. J COMFORT: the user only needs to carry one device (the reader).
DISADVANTAGES	L NO IT FACILITY FOR SAVING DATA. L Is not suitable for managing individual events. L LIMITED USE: farmers who tested this solution quickly wanted to get a PC in order to be able to use more powerful software. L COMMUNICATIONS (Driver) developed for a reader model and a printer model.
Despite being easy to use, this is only an interim solution compared with one that makes use of information. The limitations are to do with the equipment (a different driver is required for each printer). It can, however, be used simply as a means of meeting the statutory requirement to print out official documents.	

2.3 - PORTABLE reader + PC	Stationary animal DEFERRED use
Implementation and operation	 **1.** animal tags are read on a sheep farm. **2.** in the office, the reader is connected to a PC, the list of animals read is transferred onto it and the data is used (the list is printed out, an event is registered, an identification number is associated with other information, etc.). Once the data is on the computer, it can be used in a range of different ways, but for more sophisticated functionality, the user has to have the IT expertise to be able to develop their own flock management software.
Equipment	Portable readers + desktop PC + reader application for transferring data from the reader onto the PC.
ADVANTAGES	J RELIABLE reading, no data entry errors. J EASY TO USE hardware. J COMFORT: the user only needs to carry one device (the reader). J READER FUNCTIONS (depending on the models): batching, searching for animals, etc.
DISADVANTAGES	L Is not suitable for managing individual events. L Requires IT expertise.
This solution may be appealing for developing simple applications, such as sending notification information to a facility outside the farm. Currently, no applications of this type exist.	

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

ELECTRONIC READING ON FARMS WITH FIXED SYSTEMS

Aim(s)

- Rapidly sort batches of animals.
- Register information using a fixed reading system.
- Make use of the information read on the basis of requirements, in combination with other information (weight, gender, age, etc.): multi-criteria sorting.

Targets users

Farmers (or groups of farmers) who manage large numbers of animals.

Schematic diagrams

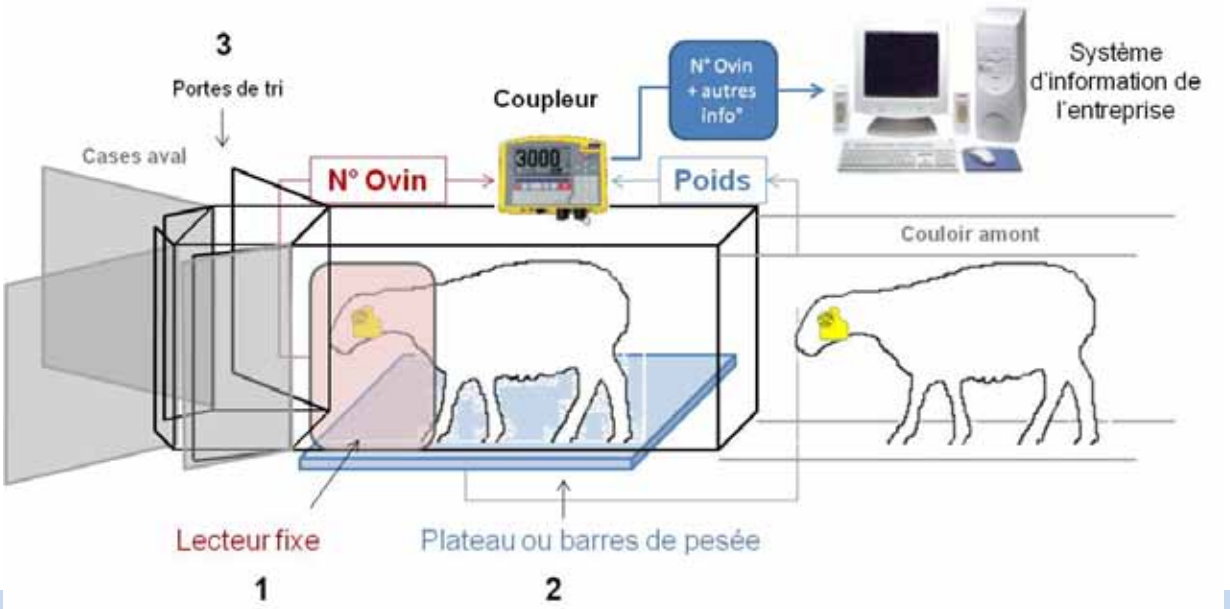
- **fixed reader solutions with or without weighing and with or without automated sorting**

The identification numbers of the sheep are automatically noted when they pass through a pen fitted with a fixed reader.

Three equipment configurations are possible [cf. diagram below]:

- Reading & weighing (**1** + **2**): the number read is directly transmitted to the automatic weighing device to automate the association between weight and number read.
- Reading & automated sorting (**1** + **3**): the number read is transmitted to the sorting door management system. Animals are sorted into boxes downstream on the basis of the selected criterion/criteria.
- Automated reading, weighing & sorting (**1 + 2 + 3**): The various pieces of information are combined together (either by the automated weighing device, or by an autonomous device) and then transmitted to the farm's IT system in a useful format: sort list, list of animals weighed, list of read failures.

These solutions enable read failures to be managed, either by blocking the animal into the pen in the reading area for the time it takes to correct the read failure (either visually or using a mobile reader) and manually enter the number; or by having one of the sort system's channels set aside for funnelling these read failure animals into a downstream box so that the numbers can be properly read subsequently.

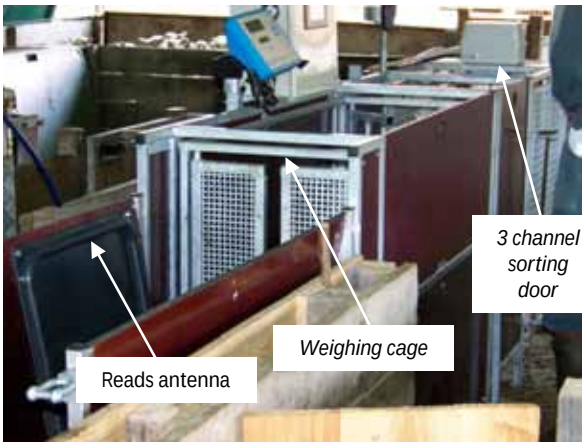


Examples of (transportable) penning systems that have been adapted for electronic reading (with weighing and manual sorting)

Gallagher reading-weighing device (Charolles farming college, Saône-et-Loire).

EIDTrace reading-weighing device (Farms, the Lot region).

Examples of fixed penning systems that have been adapted for electronic reading (with weighing and automatic sorting)



LG Produkter reading-weighing device (CIIRPO, Mourier farm, Haute-Vienne).

Dab System reading-weighing device (used on a farm, Puy-de-Dôme) [photo taken during a demonstration at a regional farming fair].

Solutions tested

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH WEIGHING DEVICE AND MANUAL SORTING DOOR (TRANSPORTABLE SYSTEM)

Reader	Status	Date brought into service	Site
Gallagher system (reader & weighing system) Maréchalle (pen) - EidTrace (software)	Operational	2008	Charolles farming college (71)
Gallagher system (reader & weighing system) Prattley (pen) - EidTrace (software)	Operational	2009	Farms in the Lot (46)

Focus: the device used at the Charolles farming college

A device that is reliable and easy to implement
A read-weigh system with a high flow rate:
120 animals per hour (including assembly and disassembly).
Batches read with a 100% success rate when the flow of animals is properly regulated; read failures can be entered manually (in the absence of electronic tags).
A bulky device which is difficult to move from farm to farm.

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH WEIGHING DEVICE AND AUTOMATED SORTING DOOR (TRANSPORTABLE SYSTEM)

Reading device	Status	Date brought into service	Site
LG Produkter system	Operational	2008	CIIRPO (87)
"Dab System" system	Operational	2009	Elevage (63)

Focus: the device used on the farm in the Puy-de-Dôme

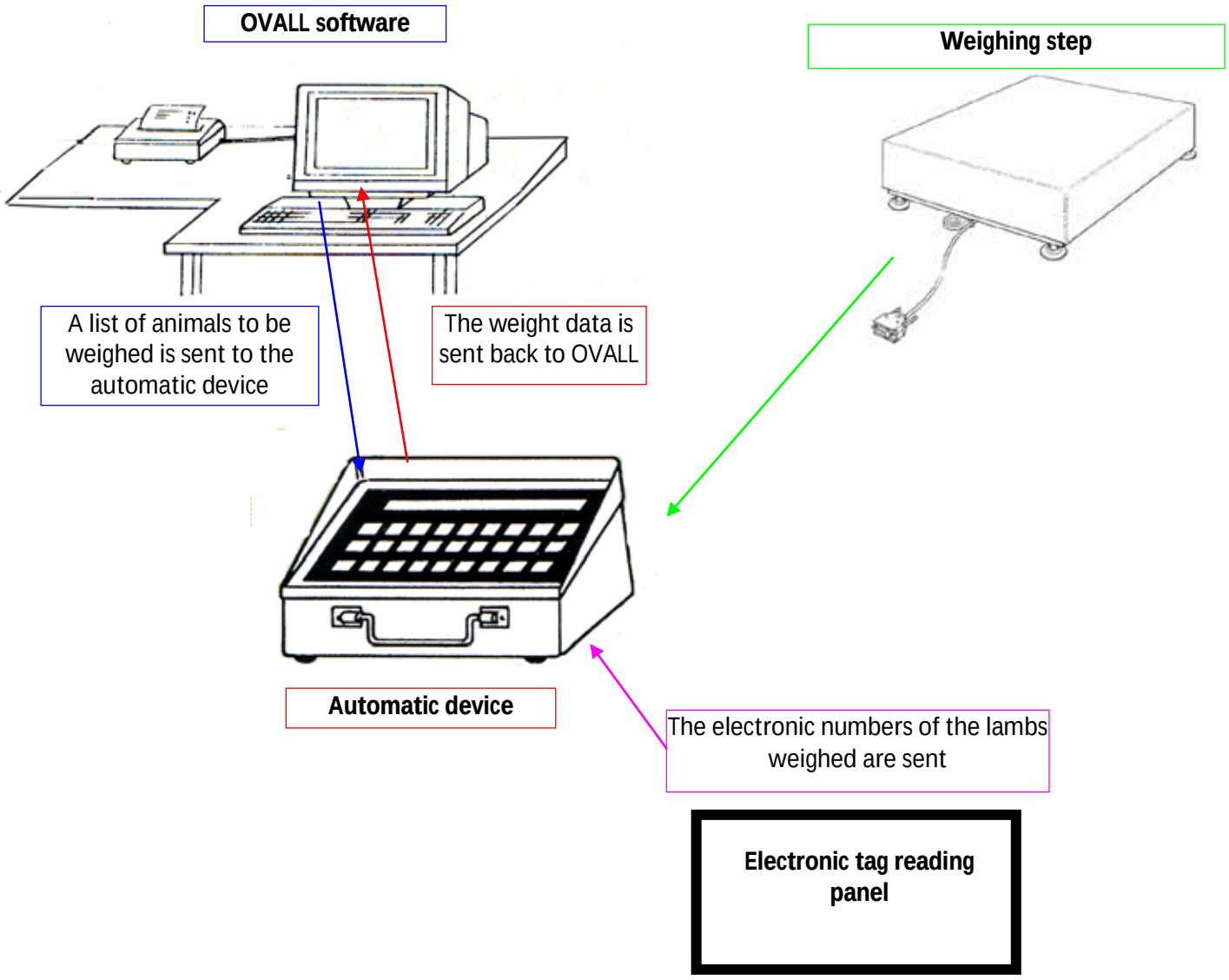
A prototype device which can be used to carry out multi-criteria sorting. It therefore requires time and IT expertise on the part of the farmer.
It has a flow rate of 300 lambs per hour for animals that have been sorted before leaving for the abattoir, taking weighing and other handling into account (evaluating body state).
A flow rate of 500 ewes per hour in sorting mode. The speed at which operations can be carried out is limited by the supply of animals from the "cheese" type pen upstream of the reading device.
100% read success rates on 3000 animals.
This mobile device can be operated by a single person (or even without any human intervention for animals that are accustomed to the system, with the door upstream being opened automatically); however, the involvement of a second person ensuring that the animals move continuously through the device can bring about significant time savings.
The user says he is very satisfied with this reading-weighing-sorting device.

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

AUTOMATED WEIGHING FOR SUCKLING PERFORMANCE SUPERVISION

Users: Performance supervision bodies which want to make use of being able to electronically read animals' RFID tags, combining electronic reading and an automated weighing device.

Operation and implementation



Using an automatic weighing device with an electronic tag reader and weighing scales:

1. tag is read è number transferred to automated device
2. lamb weighed è weight transferred to automated device
3. data transferred to OVALL at the end of the weighing operation

Two types of use have been tested:

	Equipment	Sheep crush	Use
1	FIXED reader + scales	Cradle	REAL time
2	FIXED reader + scales	Pen	REAL time

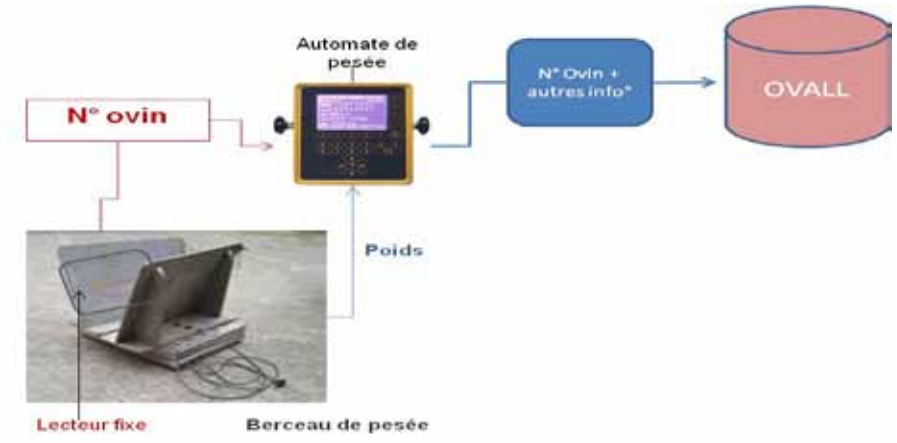
Conditions of use

- CRADLE: used for "30 day" animals.
- WEIGHING PEN: used for "70 day" animals.
- Device can be dismantled so that the weighing system can be transported.

Conditions of deployment

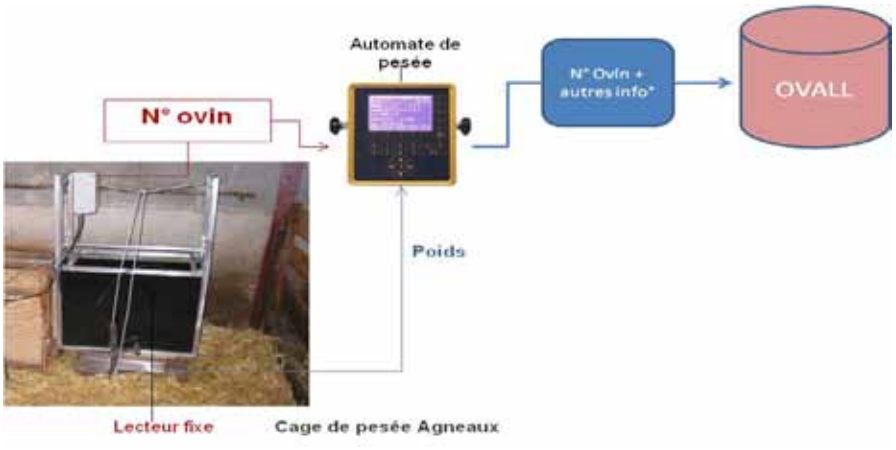
Given the wide variety of weighing devices used in performance supervision, the lack of compatibility between current automatic weighing devices and the reading equipment that could be used in conjunction with them is noted.
For performance supervision bodies which do not have weighing systems (for example, BALEA) that are compatible with a fixed reader, a number of alternative scenarios and changes/adaptations to reading-weighing systems are in the process of being looked into and will form part of practical proposals so that electronic tagging can be used. These alternative scenarios look into different areas for development:

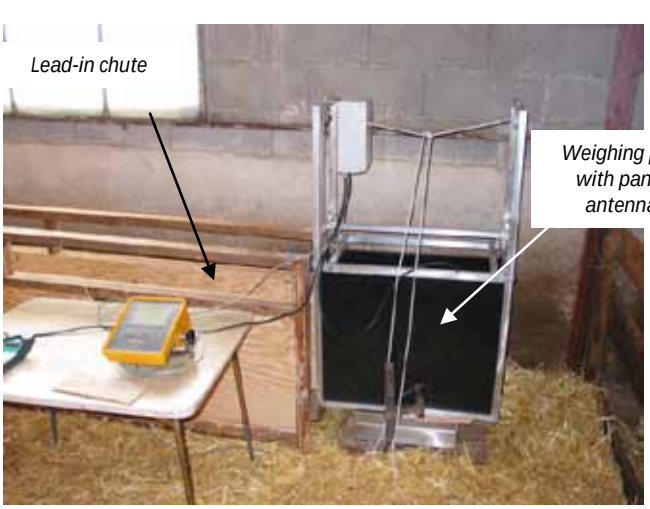
- systems that avoid having to use automated weighing devices for associating weight and number,
- systems that use mobile readers.

4.1 - FIXED reader + CRADLE	Stationary animal Use in REAL TIME
Implementation and operation	 A list of lambs at the farm is loaded into the automated weighing device. **1.** the tag is read and the number transferred to the automated device, **2.** the lamb is weighed and the weight transferred to the automated device. **3.** option to enter (or correct) the animal's gender. **4.** the data is transferred to OVALL
Equipment	Fixed reader, automated BALEA weighing step, home-made cradle.
ADVANTAGES	J RELIABLE reading, no data entry errors. J COMFORT and SPEED (an average of 300 lambs per hour and a maximum of 600 lambs per hour). Time savings of 20 to 25% compared with a conventional weighing system. J Can be used immediately. J SIMPLE: easy installation and transport.
DISADVANTAGES	L The automatic weighing device can only be loaded with data from a single farm at a time. This creates problems when organising "weighing tours": a laptop computer is needed. L Not suitable for lambs that are more than 30 days old; issues of weight stabilisation and problems handling the animal. L The device is battery-operated, so its AUTONOMY needs to be monitored.
General advantages	As well as improving output during performance supervision operations, automating weighing ensures that the data generated is 100% reliable - it completely removes the risk of any animals being weighed twice. If the device is used in conjunction with farming software for retrieving date of birth information, the whole performance monitoring concept is rendered secure in terms of the gathering of data. Furthermore, the need to correct data is completely removed, as are all sources of error. At this level, there are real possibilities for the system to be used and for technical support to be provided immediately.

Weighing cradle with integrated read antenna (CP 81).

Overall view of the automated cradle weighing device (CP 54).

4.2 - FIXED reader + weighing pen	Stationary animal Use in REAL TIME
Implementation and operation	 A list of lambs at the farm is loaded into the automated weighing device. **1.** the sheep crush is installed at the end of the lead-in chute. **2.** the scales and reader are connected up to the automated device. **3.** the tag is read and the number transferred to the automated device. **4.** the lamb is weighed and the weight transferred to the automated device. **5.** option to enter (or correct) the animal's gender. **6.** the data is transferred to OVALL.
Equipment	Fixed reader, automated Balea weighing step, home-made lamb pen.
ADVANTAGES	J RELIABLE reading, no data entry errors. J COMFORT: reduces the difficulty of the task for the farmer and technician - they do not have to handle the animals. J SIMPLE: easy installation and transport.
DISADVANTAGES	L SPEED of weighing (very variable, depending on how well managed the animals are as they are led down the chute) average of 125 to 150 lambs per hour. L Not suitable for "30 day" lambs - these animals move too slowly. L System takes a long time to be installed: assembly/reassembly of the system at each farm, stability on the ground at the place where the sheep crush is set up.
General advantages	As well as improving output during performance supervision operations, automating weighing ensures that the data generated is 100% reliable - it completely removes the risk of any animals being weighed twice. If the device is used in conjunction with farming software for retrieving date of birth information, the whole performance monitoring concept is rendered secure in terms of the gathering of data. Furthermore, the need to correct data is completely removed, as are all sources of error. At this level, there are real possibilities for the system to be used and for technical support to be provided immediately.



Lamb weighing pen with integrated read antenna (CP 81).

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

ELECTRONIC READING DURING ANIMAL COLLECTION TOURS

Aim(s)

- Print out movement documents or removal forms with individual numbers, in real time.
- Provide individual notification every time an animal is loaded or unloaded, in compliance with future regulations.
- Make use of the information read to meet the company's requirements (tour management).

Targets users

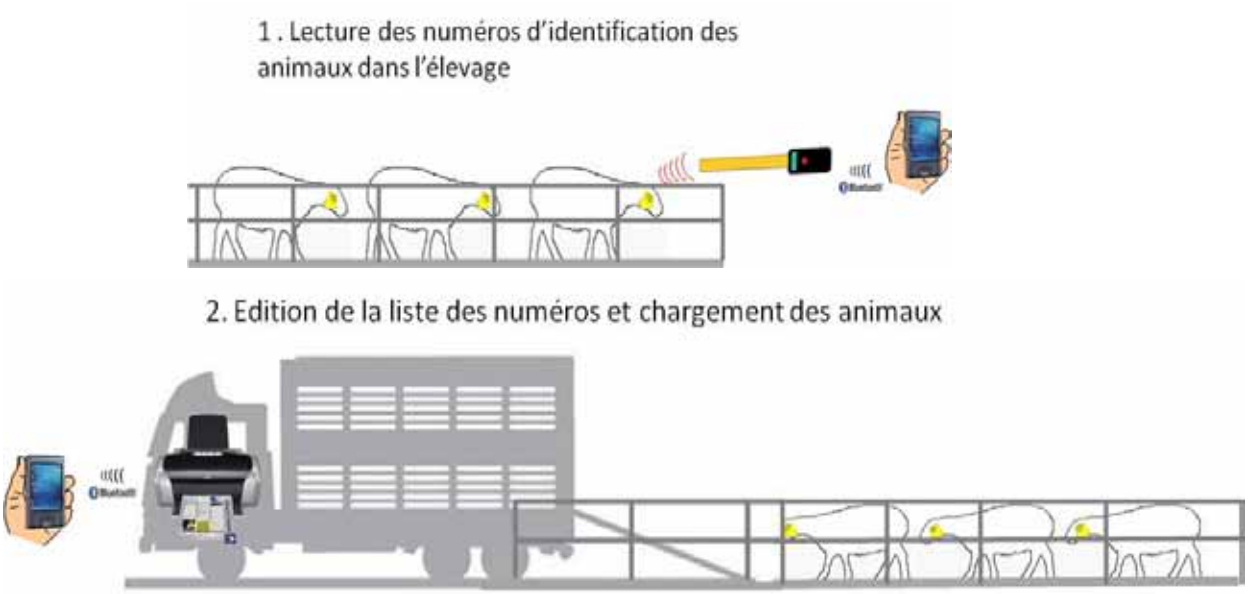
Sales operators transporting animals, either in their own right, or as delegatees.

Schematic diagram

The driver of a collection lorry has a dedicated PDA running a collection tour management application. A mobile reader is linked to the PDA via a Bluetooth® connection.

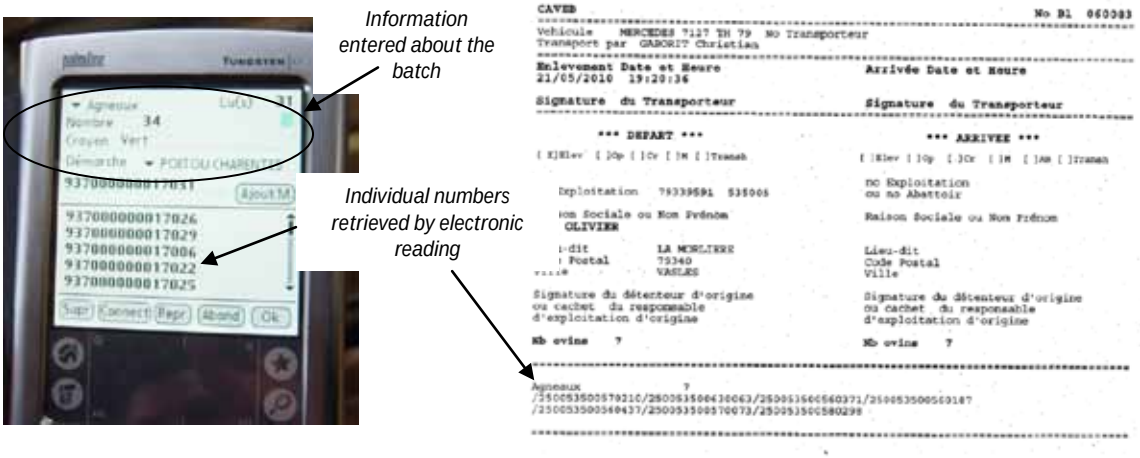
1. when the driver collects the animals at the farm, he:
    a. enters general information about the animal batches collected.
    b. reads the electronic tags of the animals to be loaded. This feeds a list of animals in the collection tour management application.
2. Once the animals have been loaded into the lorry, the driver establishes a Bluetooth® connection between his PDA and the on-board printer in his lorry, and prints out a movement document listing the individual numbers of all the animals. He gives this document to the farmer

If the collection device is integrated into the facility's IT system, at the end of the tour, the driver synchronises his PDA with the facility's PC.



Individual numbers being acquired by electronic reading during a collection tour (GEBRO, Aveyron & BNE, Aisne)

Individual list of animals being drawn up and printed out (BNE, Aisne).



Individual numbers being fed into the collection management software, and printing out of the movement document with batches separated out (CAVEB, Deux-Sèvres).

Solutions tested

PORTABLE READER + PDA + ONBOARD BLUETOOTH® PRINTER

Readers	Software	Status	Date brought into service	Site
Réseaumatique Reyflex Allflex	SoftMouv'	Operational with MD function working	2009	CAVEB (79)
Agid	OVITOUR	Operational with MD function working	2010	COBEVIM (52)
Allflex	GICAB	Operational with animal list compilation feature working	2010	BNE (02)

MD: movement document

Focus: the COBEVIM system

An operational device with tour management software which is used to draw up the movement document and which is connected to the co-operative's IT system.
A system which is designed to be used by the driver. Simple equipment which is robust and easy to use.
Extra collection time which is variable compared with a conventional collection operation (estimated 50% increase in collection time), depending on the quality of the penning and loading systems used on the farms and the size of the batches.
Well-organised penning at the farms is essential in order for this operation to work well.

Focus: the CAVEB system

An operational device with tour management software which is used to draw up the movement document and which is connected to the co-operative's IT system.
The data read is made more reliable with details being entered into a computer before loading.
A system which requires that the animals read be marked so as to avoid wasting time (rereading the same animals) and forgetting to read certain animals.
An increase in the amount of time (twice the time) it usually takes to collect animals on farms which are generally well equipped with pens.
An operation which cannot be implemented on farms that do not have penning facilities (cannot be extended to all members of the corporative).
Involves training drivers on all aspects of the system, from electronic reading to making use of the data.

PORTABLE READER ON A FIXED SUPPORT

Readers	Software	Status	Site
Réseaumatique	CBI	System which involves carrying very light lambs (less than a month old) to the reader. This solves penning problems for very small animals.	Roquefort confederation (12)

FIXED READER ON THE LORRY'S LOADING BRIDGE

Readers	Status	Site
Réseaumatique	Tests carried out in 2005-2006 Non-functional system: installation problems (significant amount of cabling, lorry's metallic environment, width of bridge to modify), difficulties managing the flow of animals, system which cannot be used to manage electronic read failures.	CCBE (23) GEBRO (12) UNICOR (12)

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

Conditions of implementation

- Reading equipment that is light and easy to install should be chosen: currently, mobile readers are the only viable option, until fixed solutions are developed in the future.
- Lorries must be fitted out and adapted:
    - On-board equipment: mobile reader + PDA (or all-in-one reader), printer, penning system,
    - Electrical power supply for the printer, system for recharging the reader's battery.
- A system is required for ensuring that the number of animals read tallies with the number of animals present (animals read should be marked), and reading devices should be used that can manage read duplicates.
- There should be a reading security system in the event of the reader developing a fault: users should at least have a spare battery and/or a spare mobile reader in full working order with a fully charged battery.
- As far as the software is concerned:
    - depending on the original situation, the in-house information system should be created or modified with the aim of the company being able to make use of the data,
    - the IT service provider and reading equipment manufacturer should be in contact with one another so as to determine what options are available for enabling the reader and the application software to communicate (data output formats, connectors, wireless connections, etc.),
    - the data acquisition software should be able to integrate both numbers that are read and identified electronically, as well as ones that are entered manually.
- Drivers should receive training for using the equipment and software.

Conditions of deployment

- Discussions about integrating individual reading should be held within the company:
    - expected applications,
    - training staff/raising their awareness.
- Raising the awareness of farmers (persuade them, compel them...) of the need to implement a penning system that is suitable for loading and fast reading.
- Get the IT service provider and reading equipment manufacturer to communicate before the device and software are purchased.
- Secure after sales service and a maintenance contract for both the device and the software (for the system as a whole, rather than separately, if possible).
- Have battery recharging systems in the lorries in order to deal with Bluetooth® technology which is very energy-hungry.
- Designate one person in the company for monitoring how the system functions (maintenance, fault management) with suitable training.

Average investment cost

- Portable reader (€600 to €1000 excl.VAT), PDA (€250 to €400 excl.VAT)
- “All-in-one” reader: €1,000 excl. VAT
- Bluetooth® printer: €400 excl. VAT
- IT development.

ELECTRONIC READING AT A COLLECTION CENTRE

Aim(s)

- Print out movement documents or removal forms with individual numbers, in real time.
- Provide individual notifications every time an animal is loaded or unloaded (when an animal enters or leaves), in compliance with future regulations.
- Make use of the information read on the basis of requirements, in combination with other information (weight, gender, age, etc.):

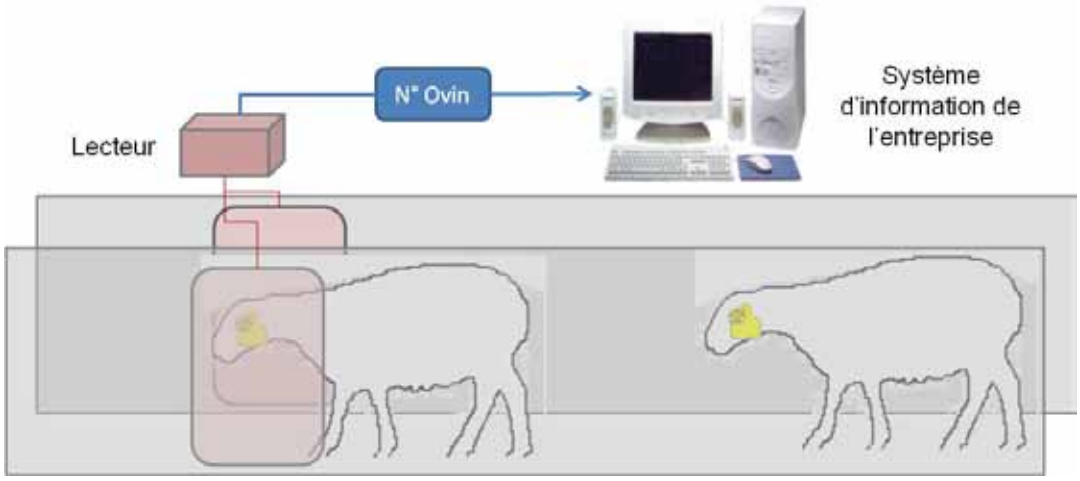
Targets users

Sales operators managing animals as they arrive and leave

Schematic diagrams

- **Fixed reading solutions in a chute**

These solutions involve retrieving the numbers as they are read from the animals using panel antennas fixed to pens, and then sending them to the facility's IT system.
Such solutions cannot be used to manage read failures - for this they would require support from additional systems (a stop door, etc.).



Examples of chutes that have been adapted for electronic reading

Integration of a Réseaumatique panel into a working chute at an unloading area (CCBE, Creuse).

Integration of a wooden panel containing a Réseaumatique antenna into a working chute (CAVEB, Deux-Sèvres).

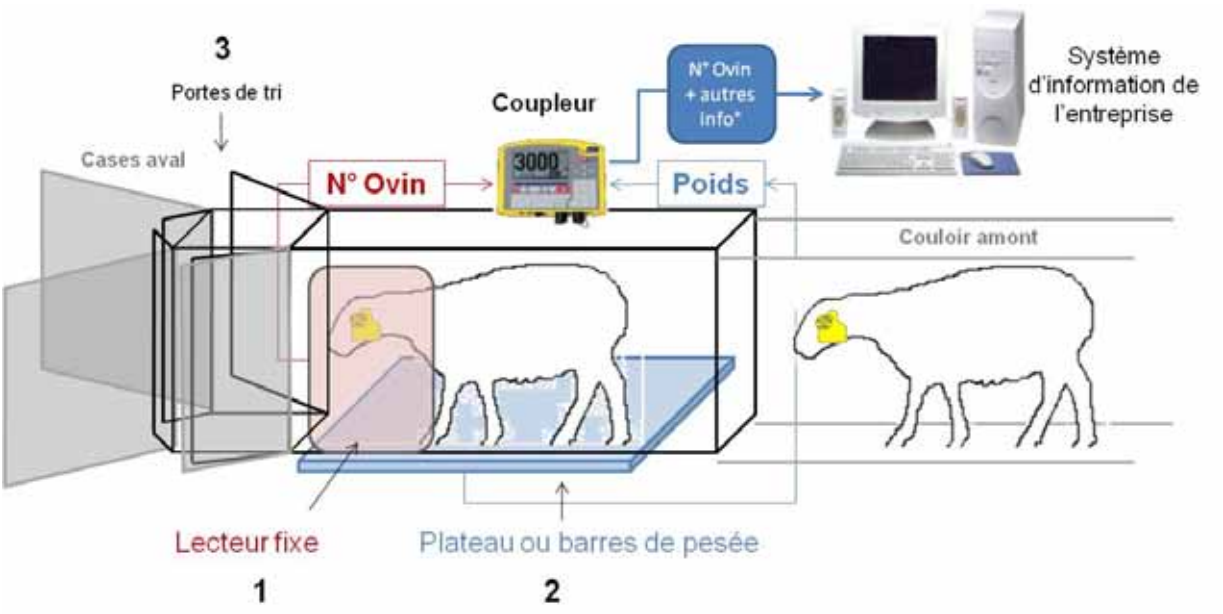
- **Fixed reader + sorting solutions, with or without weighing**

The identification numbers of the sheep are automatically noted when they pass through a pen fitted with a fixed reader. Animal entries are managed either by an operator checking them at the entry door, or automatically (using, for example, presents detectors).

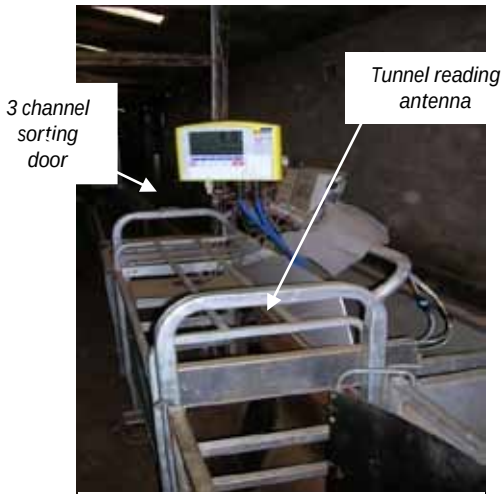
Three equipment configurations are possible [cf. diagram below]:

- Reading & weighing (**1** + **2**): the number read is directly transmitted to the automatic weighing device to automate the association between weight and number read.
- Reading & automated sorting (**1** + **3**): the number read is transmitted to the sorting door management system. Animals are sorted into boxes downstream on the basis of the number of channels in the system and/or selected criterion/criteria.
- Reading, weighing & automated sorting (**1** + **2 + 3**): the various pieces of information are combined together (either by the automatic weighing device, or by an autonomous device) and then transmitted to the company's IT system in a useful format: sort list, list of animals weighed, list of read failures.

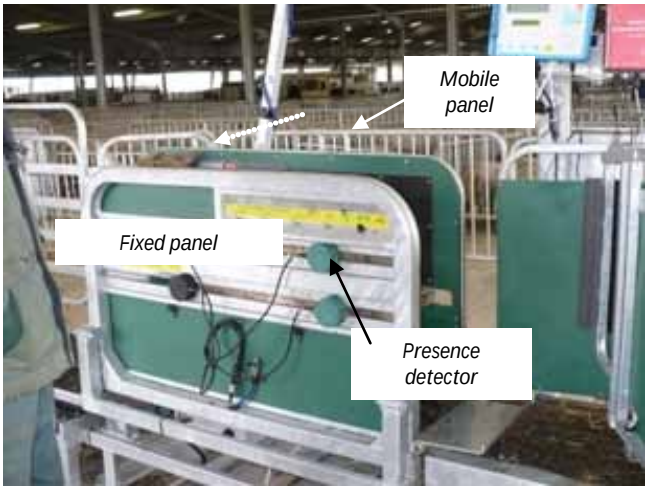
These solutions enable read failures to be managed, either by blocking the animals into the pen in the reading area for the time it takes to correct the read failure (either visually or using a mobile reader) and manually enter the number; or by having one of the sort system's channels set aside for funnelling these read failure animals into a downstream box so that the numbers can be properly read subsequently.



Examples of penning (+ weighing) systems that have been adapted for electronic reading

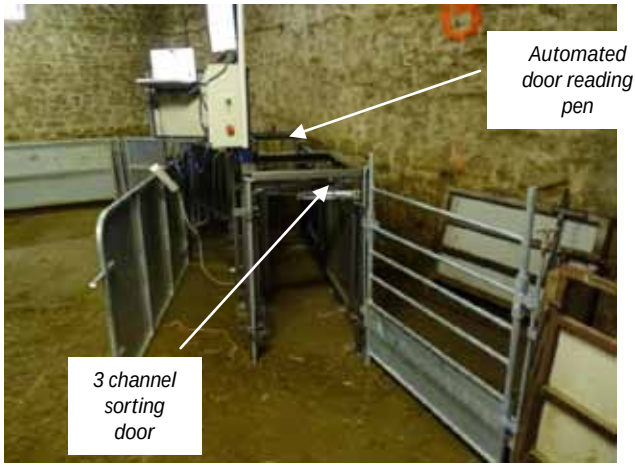


Prattley reading-sorting-weighing device [sliding door system] (COBEVIM, Haute-Marne).



Racewell device [animals blocked in at the side (vice)] (Parthenay market, Deux-Sèvres).

Examples of penning (+ automated weighing) systems that have been adapted for electronic reading



Reyflex reading-sorting device in use (COOPROVOSEL, Saône-et-Loire).

Albouy reading-sorting device (GEBRO, Aveyron).

Solutions tested

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE (without sorting door)

Reader	Status	Date brought into service	Site
Réseaumatique	Reader non-operational	2005	CAVEB (79)
	Operational	2005	CCBE (23)
	Reader positioned in adjustable chute: system considered unsatisfactory	2005	Sisteron (04)

Focus: the CCBE system

Type of device that any user can quickly get used to.
A system which is considered simple and inexpensive (pre-existing effective penning system).
Batches read with a 100% success rate when the flow of animals is properly regulated, but system does not allow read failures to be managed.
Requires an operator to regulate the flow of animals (two operators for large sized batches).

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH AUTOMATED SORTING DOOR

Reading device	Status	Date brought into service	Site
Reyflex System (reader-pen-software)	Operational with adjustments currently being carried out	2009	COOPROVOSEL (71)
Allflex System (reader) – Albouy (pen) - EID Trace (software)	Operational with adjustments currently being carried out	2009 2007	UNICOR (12) GEBRO (12)

Focus: the COOPROVOSEL system

A prototype device which required time and staff with the relevant expertise in order to install and adjust it.
A system which cannot be used to manage read failures.
Read rate of 600 animals per hour (obtained by extrapolating information from tests involving small batches).
The penning system and the way animals move through the system must be properly structured in order to take full advantage of this reading device.

FIXED READING DEVICES WITH AUTOMATED WEIGHING AND SORTING SYSTEMS

Reading device	Status	Date brought into service	Site
Allflex System (reader) – Prattley (pen) - EID Trace (software) – Trutest (weighing)	Operational	2008	COBEVIM (52)
Racewell System (pen) - Edit ID (reader – software) – Iconix (weighing)	Operational	2010	PARTHENAY MARKET (79)

Focus: the COBEVIM system

A prototype device
The building's layout had to be modified in order for this device to be integrated into the site.
A solution designed to be used by one single operator, but which requires two people in real life conditions (for managing the opening of the entry door and animals trapped in the doors + for managing the supply of animals).
Very variable throughput rate, depending on how the animals are fed into the system, with an average of 250 animals per hour.
A system which can be used to manage read failures by guiding the animals with the sorting door + having them read manually.
A device which is considered too slow compared with the expectations of the producer organisation using it.

Focus: the Parthenay Market device

A mass-produced penning solution.
A theoretical throughput with weighing of 600 lambs per hour and an actual average throughput of 400 animals per hour (varying between 300 and 500), depending on interruptions in the flow from the market.
A solution designed to be used by one single operator, but which requires two people in real life conditions: the penning upstream needs to be re-initiated between two batches of animals brought in.
System which can be used to manage read failures - animals are systematically blocked into it, meaning that a single animal is always present in the device, thus ensuring that all animals are read.
Sensitivity to surrounding conditions: the connectors are weakened by the reading box being dismantled/reassembled on a weekly basis (risk of theft). There is also a risk of the compressor's compressed air circuit freezing in winter (independent of the reading device).
It is essential that the pens and the way in which animals move around the system be properly structured in order to avoid interruptions to the flow.

Solutions tested on farms with possible applications in collection centres.

A number of solutions were tested on farms and can be used at collection centre facilities, depending on the number of animals handled on a daily basis and the way in which the company's work is structured.
Solutions which use mobile readers are better suited to smaller facilities which process smaller numbers of animals or which only do so on a very irregular basis.
Solutions which involve fixed readers integrating other management tools (scales, sorting door) can only be used at larger facilities where relatively large numbers of animals are handled on a daily basis.

PORTABLE READER + PDA (cf. sheet no.1.1)

PORTABLE "All-in-one" READER (cf. Sheet no.1.2)

PORTABLE READER + BT Printer (cf sheet no.2.2)

PORTABLE READER + PC (cf. sheet no.2.3)

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH MANUAL SORTING DOOR
Néodis/Destron (Nationale Rambouillet-Yvelines Sheep Farm)

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH WEIGHING DEVICE AND MANUAL SORTING DOOR [TRANSPORTABLE SYSTEM] (cf. topic no.3)
Gallagher Reader - Maréchalle pen - EidTrace software (Charolles farming college – Saône-et-loire)
Gallagher Reader - Prattley pen - EidTrace software (Farms - Lot)

FIXED READER WITH A FIXED PANEL ANTENNA IN A CHUTE WITH WEIGHING DEVICE AND AUTOMATED SORTING DOOR (cf. topic no.3)
LG Produkter (Le Mourier – Haute-Vienne)
Dab System (Boyenval Farm – Puy-de-Dôme)

Other solutions possible (not tested for the projects)

Agid (Fedatest – Haute-Loire)

LITAMS (Ferme du Mourier – Haute-Vienne; Delpech Farm - Lot)

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

Conditions of implementation for reading devices at collection centres

- A permanent fixed pen installation is required, regardless of the type of reader used (fixed or mobile).
- The pen installation should be adapted in three ways as follows:
  - upstream, in order to lead the animals into the read range (manual or automated system). It should be remembered that dogs that have been trained to work in buildings can provide assistance with this,
  - in the reading area, on a per-unit basis,
  - at the exit, in order to manage the batches that have been put together on the basis of criteria defined by the operator, with electronic read failures making up at least one batch.
- A system is required for managing read failures (automated or manual sorting).
- The power supply should be reliable.
- There should be a reading security system in the event of the reader developing a fault: users should at least have a spare mobile reader in full working order with a fully charged battery, and a pen that can be used with this reader.
- As far as the software is concerned:
  - depending on the original situation, the in-house information system should be created or modified with the aim of the company being able to make use of the data,
  - the IT service provider and reading equipment manufacturer should be in contact with one another so as to determine what options are available for enabling the reader and the application software to communicate (data output formats, connectors, wireless connections, etc.),
  - the data acquisition software should be able to integrate both numbers that are read and identified electronically, as well as ones that are entered manually and/or integrate the backup reader.
- Staff should receive training for using the equipment and software.

Conditions of deployment

- Discussions about integrating individual reading should be held within the company:
  - Choice of equipment and software, on the basis of:
    - § expected applications,
    - § how the way in which work is structured needs to be redefined,
    - § the building and the machinery that needs to be upgraded.
  - Training staff/raising their awareness.
- When installing a fixed reader, a pre-installation visit should be requested (feasibility study) from the manufacturer of the reading equipment (unless it has already been decided to acquire a mobile reader). In decisions about the device and whereabouts it should be positioned relative to the installations, the following should be taken into account:
  - electromagnetic interference,
  - electrical installations (power supply),
  - interface with the IT system.
- A fixed reader should be installed by the manufacturer, working closely with the IT service provider.
- Whatever reading equipment is purchased, after sales service and a maintenance contract must be secured for the whole reading system.

· Designate one person in the company for monitoring how the system functions (maintenance, fault management) with suitable training.

Average investment cost

- Fixed reader (one or two antennae): €2,500 plus VAT on average not including installation costs.
- Reading device with sorting and/or automated weighing system: €10,000 to €15,000 plus VAT not including installation costs.
- IT development.
- Adapting the penning system.

ELECTRONIC READING ON THE SLAUGHTER LINE

Aim(s)

- Provide individual notification every time an animal enters an abattoir, in compliance with future regulations.
- Make use of the information read to meet the company's requirements.

Targets users

All abattoirs.

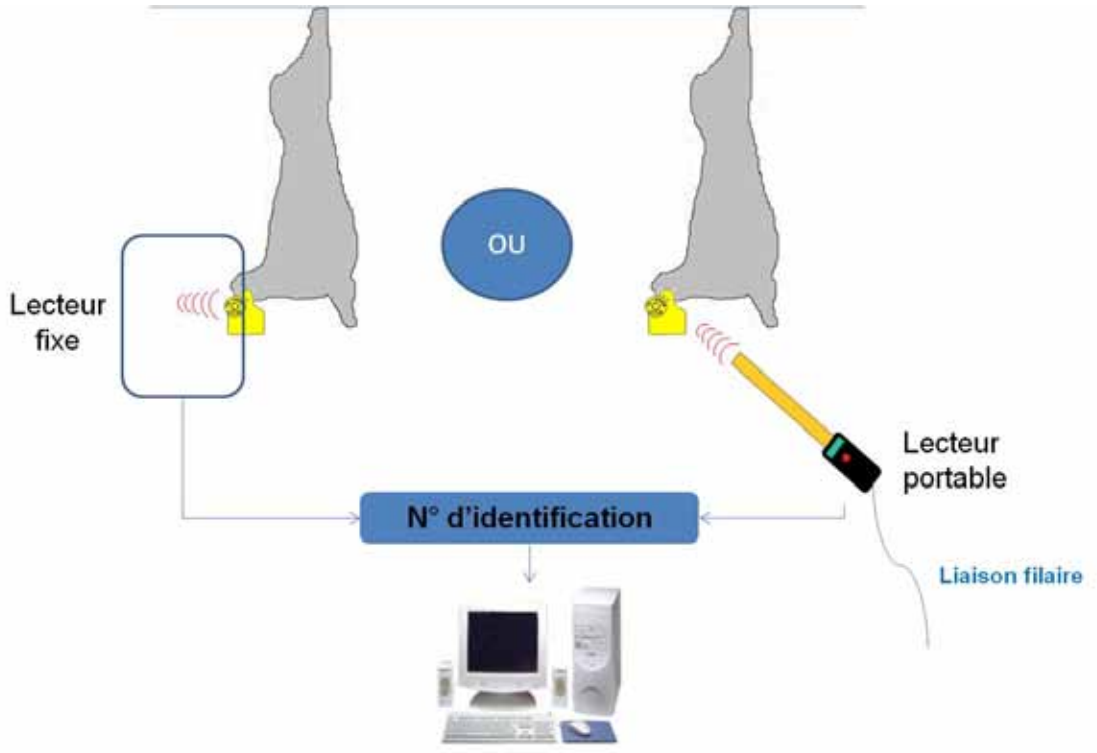
Schematic diagram

Electronic identification is used as a means of facilitating or automating entry of the animal's number. This operation may need to be carried out several times, until the animal's ear is cut off.
The reader, fixed or portable, is powered on a continual basis and can be connected, like a telescopic barcode reading head, to various stations along the length of the slaughter line. Different stations along the slaughter line were tested as part of the pilot projects: from the drainage facilities to the fiscal weighing scales.

The carcasses are separated from one another, and so there is no risk of collision (several tags entering the reading field).

A very minor modification needs to be made to the abattoir management software in order to retrieve the number as it is read by the reader.

Equipment: fixed reader, or cable-connected portable reader / PC running the abattoir's software to retrieve the data.



Solutions tested

FIXED READER

- **Reader box + 1 or 2 antennae fixed to the wall or fixed support**

Site	Reader	Location	Status
Le Vigeant [SODEM] (86) Bessines (87)	Elisphère, installed in 2005. Taken over in 2009 by ITW Reyflex.		Reading made very difficult by problems with electromagnetic interference, which have so far not been resolved (May 2010).
Thouars (79)	Réseaumatique (2 antennae), installed in 2005	At the classification station.	Worked for the first few years. Reader has since become faulty over time.

Focus: the device in use at the Le Vigeant abattoir (86)

In 2005, the system, which had been adapted for use on the slaughter chain, was working perfectly from reading through to the numbers being retrieved. The average electronic read rate was 78%, with certain batches being read 100% successfully.
In 2010, the reader is still working, but the system can no longer be used to send the numbers read to the abattoir software.
Electromagnetic interference problems have been highlighted, limiting the effectiveness of the antenna and making it impossible to connect the reader to the abattoir's IT system.
The time required to manage read failures is considered too great relative to the speed of work on the line.
Solutions have been looked into and should lead to new proposals.

- **reader box + 1 or 2 antennae fixed to the wall or fixed support**

Sisteron (04)	Réseaumatique (2 antennae), installed in 2005	At the classification station.	Worked for the first few years. Reader has since become faulty over time (read distance has decreased)
	Gallagher, tested in 2009	In a drainage chute.	No reading problems. Device not connected to the internal IT system
Grillon (84)	Réseaumatique, installed in 2005	Between the slaughterhouse and the beginning of the line.	Device not connected to the internal IT system. Reader has since become faulty over time
	Gallagher, tested in 2009	In a drainage chute.	Reader works, but is not connected to the abattoir's IT system

Focus: the system in use at the Sisteron abattoir (04)

The read rate is in keeping with the speed at which the line works (295 animals per hour).
The system has not been connected to the abattoir's IT system.
Results recorded:

A Réseaumatique device which had an average read rate of 95% in 2005; the device stopped working in 2009, and can no longer be used for reading numbers.
Two Gallagher antennae of different sizes tested in 2009. On the same batch of animals, the electronic read rate was 100% with a small antenna located on the tag side and only 47% with a large antenna on the opposite side.

- **reader box + 1 antenna, fixed to a mobile support**

Site	Reader	Location	Status
Gramat (46)	Elisphère, installed in 2005. Taken over in 2009 by ITW Reyflex.	Fixed to a mobile support on wheels.	Operational

MOBILE READER connected to a PC via a cable connection

Site	Reader	Location	Status
Laon (02)	Allflex, installed in 2009. Elisa software, connected to a central server for connection with farmer and farm data entered beforehand.	At the fiscal weighing machine.	Operational
Rodez (12)	Elisphère, installed in 2005.		No data

Focus: the system in use at the Laon abattoir (02)

With a slaughter line speed of 50 to 60 animals per hour, electronic reading is perfectly suited to the way in which the facility operates, but does not have any major advantages, apart from ensuring that animal numbers are retrieved reliably.
The system is designed to be used by one single operator and integrated into the facilities' usual working methods, without increasing the labour force involved in the operation.
The Bluetooth® connection does not work in the abattoir, meaning that a cable connection has to be used.
Read failures are managed by barcode reading, or by reading the numbers manually.
A device which is completely integrated into the abattoir's IT system.

FIXED READER BOX + MOBILE ANTENNA

Site	Reader	Location	Status
Bellac (86)	Elisphère	Installed in 2005.	Operational

Focus: the system in use at the Bellac abattoir (87)

The numbers of unreadable electronic tags and of non-electronic red tags mean that somebody is required to man the IT entry station (TEISA), despite the increase in the numbers of sheep being identified electronically.

The portable reader used by the technician at the "TEISA" system appears currently to be the best suited system. Especially because for years to come, the abattoir will have to process both batches with electronic tags and batches with conventional tags, as well as animals with markers at different heights (tags, and possibly pastern rings on goats).

As such, the device tested in Bellac seems to be a credible solution, a least initially, for abattoirs in the west of France.

For more information about the solutions tested, refer to the regional technical sheets and the project reports.

Conditions of implementation

- Regarding the equipment:
  - place the reader on the basis of:
    - where the markers are located on the animals (head, pastern). This can determine the position and size for fixed readers,
    - whereabouts the workstations are located on the line, and particularly the removal of the parts of the animals to which electronic markers can be attached: ears (tags), feet (pastern ring for goats), even internal organs (ruminal boluses for animals that have been purchased from other European countries).
  - develop a system for managing electronic read failures (for when there are no electronic markers, or for when they do not work):
    - if using a fixed reader: a system to alert the operator and identify animal read failures (presence detector) so that they can read non-read numbers visually,
    - if using a mobile reader: a system whereby the operator can read non-read numbers visually.
  - there should be a reading security system in the event of the reader developing a fault: users should at least have a spare mobile reader in full working order with a fully charged battery.
- As far as the software is concerned:
  - depending on the original situation, the in-house information system should be created or modified with the aim of the company being able to make use of the data,
  - the IT service provider and reading equipment manufacturer should be in contact with one another so as to determine what options are available for enabling the reader and the application software to communicate (data output formats, connectors, wireless connections, etc.).

Conditions of deployment

- Discussions about integrating individual reading should be held within the company before any decisions can be made about what equipment to purchase:
  - adapting workstations,
  - expected applications,
  - training staff/raising their awareness.
- A pre-installation visit should be requested (feasibility study) from the manufacturer of the reading equipment (unless it has already been decided to acquire a mobile reader). In decisions about the device and whereabouts it should be positioned relative to the installations, the following should be taken into account:
  - electromagnetic interference,
  - electrical installations (power supply),
  - how the line is structured (whereabouts the electronic marker is removed, workstations, wall or other supports, cleaning system, etc.),
  - interface with the IT system.
- The installation should be carried out by the manufacturer, working closely with the IT service provider. After-sales service and a maintenance contract should be secured.
- Designate one person in the company for monitoring how the system functions (maintenance, fault management) with suitable training.

Average investment cost

- Portable readers: €600 to €1000 plus VAT.

- Fixed reader (one or two antennae): €2,500 plus VAT on average not including installation costs.
- Presence detection system (with fixed reader).
- IT development.
-

4 GENERAL OVERVIEW

4.1 Wide-scale deployment of identification

In order to deploy electronic identification on a wide scale and use it for tracking purposes, animals born after 1st July 2010 need to be electronically identified, and those born before this date need to be electronically processed. This operation, which is required to have been completed by 1st July 2013 in accordance with French law, involves replacing the 2 types of conventional (non-electronic) tags currently in use by electronic ones. The State will bear most of the costs involved.

4.1.1 Why electronically process herds?

This is a major issue for both farmers and operators working in the sector.
This is because, in most cases, technically managing two categories of animal simultaneously would be extremely difficult: animals which have been identified electronically (those born after 2010) and those which have not been identified electronically (those born before 2010).
Otherwise, farmers, batching centres and abattoirs would have to have two separate tools, one for each category of animal, for operations involving mixed batches. Or, they would have to sort the animals into two categories before carrying out whatever operations were required in order to process them differently.
So it is clear that the benefits of electronically tagging animals - particularly in terms of automating operations and saving time - would be compromised.
The aim is therefore to electronically tag as many animals as possible in order to minimise the amount of time spent managing animals that cannot be read electronically.

4.1.2 Methods for electronically processing animals

The pre-deployment projects - with a further 200 farmers in 2009 joining the 100 farmers who had been participating since 2005 - involved having to tag 100,000 animals and served as an excellent means for investigating the problems inherent in this operation. Under no circumstances could electronically retagging the animals be allowed raise questions about identifying them - something on which the whole genetics system in particular is dependent.

The pre-deployment projects demonstrated that for electronic processing operations, considerable care had to be taken in order to minimise risks of infection associated with retagging. When a new marker cannot be attached in the same place as the one that has been removed (because the hole left is wider than the shaft of the electronic tag), the risk of infection appears to be higher, even in conditions where hygiene standards are very high. There are two reasons for this increasing number of infections:

- a second hole being pierced into the ear (the cartilage being damaged twice), sometimes too close to the first.
- tag shafts which are too short. This can lead to the tissue being macerated and chewn up, delaying the healing process.

With the help of the experience acquired during these projects, precise procedures have been developed, meaning that these electronic processing operations - which will be managed by the EdEs (regional livestock centres) - can now be carried out safely. Similarly, farmers can now be provided with technical recommendation sheets.

4.2 The technology and using it

4.2.1 Reliability of reading

- **The ease with which tags can be read**

The electronic identification markers are the platform on which the individual traceability required by European legislation is based. Given the investments that this involves in terms of equipment and software, as well as the work involved in implementing it, the quality and integrity of the electronic tags are of paramount importance for the whole traceability system.

Three factors can permanently affect the electronic legibility of the tags (or markers) involved in electronic identification:

1 - The manufacture of the marker: if the plastic section into which the electronic component is moulded is not firmly held in place on the animal, it can fall off.
There have been few incidents of this nature since 2005 - except one-off incidents on a few manufacturing batches. The manufacturers involved looked into the causes and replaced the faulty tags at their own expense. The manufacturing processes were then improved and the problems resolved. As a general rule, information passed up from the farmers indicates that the tags stay in place at least as well as - if not better than - conventional tags.

2 - The manufacture of the electronic component of the marker:
In 5 years of projects involving sheep, no mid/long-term reading incidents were reported until 2009, for tags whose operation had been immediately verified just after they had been fitted.

As part of the drive to deploy electronic identification on a wider scale, moving from pre-mass production adjusted for the requirements of the pre-deployment projects (fewer than half million tags), to an annual production of 8 to 10 million tags, it is absolutely vital that the manufacturers be able to guarantee their quality.
Significant numbers of brand-new tags that cannot be read could lead to major questions being asked about the viability of electronic identification. This is because of how complicated it is to replace tags (untagging/retagging), as well as the interruptions to major reading operations that it would cause - especially for sales operators at batching centres or as animals go into abattoirs.

A permanent structure for tracking the quality of electronic markers when they are delivered and throughout their lifetime therefore seems essential.

3

- Incidents when attaching the tags, leading to the electronic component being destroyed.
It has been seen that carelessly attaching tags, or attaching them using pliers other than those recommended by the manufacturer, for example, can lead to the transponder being irreparably damaged. There is a significant risk of this happening. An information campaign should be deployed targeted at farmers, with a sheet being sent to them reminding them of best practice for attaching tags. Such a campaign was launched as part of the pre-deployment project and will need to be extended throughout the deployment period.

In all cases, these factors which affect how well tags can be read, together with the cases of animals arriving at the abattoir with red tags, justify the implementation of read failure management systems, given the goal which is for each individual animal to be traceable - a goal which requires that all numbers be retrieval.

There are also a few cases of tags being temporarily unreadable in extreme cold (-10°C).

- **Tags remaining readable over time**

Beyond the configuration problems which are inherent in installing readers, they are functional and stable over time. The readers work consistently.
However, the ability of one device that was brought into service in 2005 to read tags has decreased over time. The device in question is no longer being produced or maintained made by the manufacturer, and so it has not so far been possible to determine the causes of this drop in efficiency.

- **The integrity of the numbers that are read, transmitted and stored**

The number that is encrypted into the chip always corresponds with the number marked on the tag. This is one aspect of the technology which the manufacturers have perfected.
What's more, the technology ensures the integrity of the numbers read: in the event of a problem reading the tag, the reader displays nothing.
However, although the integrity of the numbers can be guaranteed when they are being read, they can sometimes be distorted when they are being sent from the reader to one of the various applications designed to make use of them. The ISO 24631-6 norm has been developed to normalise reader output formats and so minimise the risk of information being corrupted during transfer between devices.
However, once the numbers have been transferred from a reader, they run the risk of being altered when being saved by any one of the applications designed to use them (automated weighing device, coupling box, etc.).

4.2.2 Comfortable working conditions

Automatic reading means that operators no longer have to note down numbers manually and then enter them into a computer via a keypad.
But this increase in comfort is only appreciated by people who have already had experience entering numbers manually, while other users may tend only to see the disadvantages of electronic identification (cost, the complications involved in implementing it, etc.).

4.2.3 Time savings, read speeds

When the way in which work is scheduled is affected by tasks other than taking down and entering numbers - which are more constraining in terms of the speed at which work is carried out, electronic identification clearly improves the comfort of working conditions and the reliability of the data read, rather than bringing about any genuine increases in productivity.

However, when dealing with very large batches, such as large farms herds, particularly when animal entries and exits at collection centres are concerned, using electronic identification instead of manual noting and keyboard entry can bring about significant time savings for registering numbers.

Tags need to be read on an individual basis in the following scenarios:

- on farms, when dealing with average or large herds, which already have technical management tools and flock management software,
- generally, in all situations involving Official Quality Label procedures, either on farms, when collecting lambs, or in abattoirs.

In this second scenario, a barcode system is used to identify animals, or the process is carried out visually with manual data entry. So electronic identification is seen as something which brings about time savings, compared with other systems - which often involve the tag being cleaned before it can be read - and which cannot be used to manage automated equipment.

But apart from these situations, electronic reading is still seen as a source of time constraints and extra work - even when it works. This is because of individual read failure cases (for example, collecting animals). The result is that people - sales operators in particular - cite the "read rates" of any tools which might be recommended to them as major considerations.

In regard to read rates, the pilot and pre-deployment projects have shown that the speed at which tags can be read - or flow rates - are linked to:

- the tag readability rate (which, although very high, still requires a system for managing read failures if the goal of retrieving 100% of all numbers is to be met),
- the specifications of the reading system (whether or not it has stop or sorting doors, a weighing system, etc.) and the quality/efficiency of its components (doors, reader, automated devices, software, etc.),
- the fluidity with which batches of animals enter into the system: if the flow of animals into the system is interrupted, the supply of animals into it has to be re-initialised, which takes time,
- the quality of the penning systems upstream and downstream of the system,
- how the reading system is integrated into its environment (building, etc.).

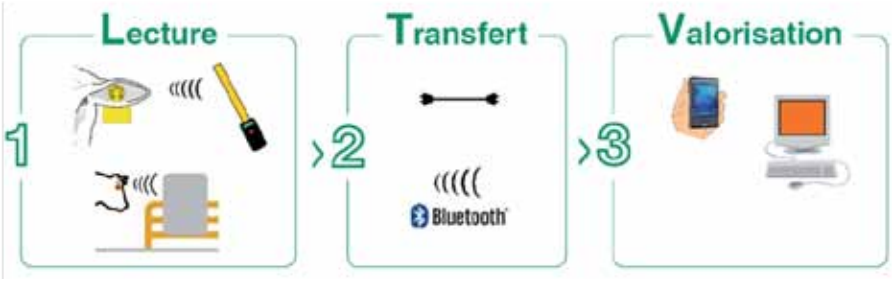
So, for fixed reading devices with systems for managing read failures, the theoretical throughput rates as advertised by the manufacturers (up to 1000 animals per hour) can be reduced by 50% - or even more - depending on the penning systems in use.

4.3 Optimum conditions for operational electronic reading and transmission of information

The pilot and pre-deployment projects demonstrated that implementing an application using electronic identification does not only involve communication between the electronic tag and the reader.

In order to take full advantage of electronic identification, and have a system whereby computerised notification is generated for all movements of animals (which is one of the applications for electronic identification), the following have to be managed:

1. The actual reading, i.e., communication between the tag and the reader.
2. The transfer of numbers (either via a cable connection or wirelessly) from the reader to the device which uses them.
3. End use, i.e. the IT processing or interfacing with automatic equipment.



Depending on the application, the site, the activity, the type of operator, etc., each of these three points can be a technical issue in its own right which needs to be completely addressed and resolved. A single problem in just one of these 3 areas can compromise any added value which electronic identification might generate.

4.3.1 Reading mode(mobile or fixed)

It has to be possible to electronically read tags in all the conditions in which the farmer or operator may be required to work.

So a number of factors have to be taken into consideration when deciding on the right kind of reader for one's requirements:

- the environment into which the equipment will be/may be integrated:
  - human: the categories of people using it,
  - equipment already in place or to be created (mainly penning, but also with regard to users' access to IT resources), the presence of automated equipment or sorting devices,
  - modifying the layout of existing buildings and developments that can be considered,
  - the number of animals to be processed in the shortest time period,
- the cost/expected benefits ratio,
- the specifications of the equipment provided by the manufacturers:
  - for portable readers, these include battery life, ergonomic design, portability, connections to peripheral devices, etc.

    Feedback from the pilot projects showed that in this respect, the devices available did not always meet requirements. Consequently, the Ministry of Agriculture invited manufacturers in September 2009 to improve their products. The following features were considered essential: LEDs to indicate mains charge and battery level, a USB socket (cable or adapter) and a user guide in French (both hard copy and in electronic format). The following features were considered very important: an on-off switch, removable batteries, a reading LED indicator, the option to increase the volume of the reading indicator, a Bluetooth®connection indicator, and an integrated Bluetooth® module.
  - for fixed readers: size, options to integrate the reader into existing structures.
  - for fixed readers integrated into sorting and/or weighing devices: performance (theoretical throughput rate, labour required), options to integrate the reader into existing structures, modification options for the movement of animals, etc.

The Institut de l'Elevage has therefore put together an "Equipment Catalogue" which is available at http://www.inst-elevage.asso.fr/html1/spip.php?page=rubrique_espace&id_espace=937&id_rubrique=2471. It lists the main technical specifications of the devices currently being offered by the manufacturers.

4.3.2 Using the data read

Using the data mainly involves processing the numbers that have been read automatically:

- by a "business" software application that processes data, either in compliance with regulations (drawing up a movement document, generating notifications about animal movements, etc.) or for professional purposes (herd management on a farm, connection to a business management system, etc.),
- by a tool which triggers an automated device (for weighing, sorting, etc.).

In all cases, IT service providers are required in order to adapt the software. Similarly, if the data read is used to trigger an automated device, specific expertise in mechanics and electronics is needed, meaning that specialist installers are required.

For the pre-deployment projects, no provision was made for the financing of software development work. So the issue was tackled in a number of different ways, depending on the situation:

- on farms: the flock management programmes available on the market have now been modified so that they can communicate with readers. They also have functionality which enables them to draw up movement documents and - eventually - to generate individual movement notifications.
  On farms that do not have IT infrastructure, a basic solution for meeting regulatory requirements involves connecting a portable reader to a printer so that lists of numbers can be printed out (cf sheet 2.2). This solution, however, requires specific configurations for each printer - configurations that only the reader manufacturers are able to recommend.

- at facilities downstream: the situations are different depending on whether the facilities have IT infrastructures or not. But for even those which do have IT infrastructure, very few of them (through a lack of resources or willingness) have had the requisite software development work carried out to enable them to connect their readers to their IT system - and so make use of their electronic identification facilities.
  Given that being able to generate movement notifications is mainly dependent on having had this software development work carried out, very few of the projects have met with expectations in this regard.

  However, as regulations become clearer and in view of the fact that all animals will ultimately be electronically tagged, it is likely that these companies will eventually find themselves obliged to have the necessary IT resources developed. Possible outlooks in this respect are looked at in chapter 5.

4.4 Interoperability of equipment

In order for the system to be used throughout the sector, equipment needs to be interoperable:

- all readers need to be able to read, display and send the numbers of all electronic tag types.
- conversely, all electronic tag types need to be readable by all types of reader.

The animals' tags and operators' readers need to be able to communicate throughout the animals' lifespan.

In order for this to be possible, technical standards have to be agreed on. For some devices, norms have already been developed, others are in the process of being standardised.

4.4.1 Technical standards and norms

- **Tags and readers**

The tags and readers must be compliant with the ISO 11784 and 11785 norms. Essentially, all readers must be able to read ISO compliant tags, i.e., tags with low-frequency (134.2 kHz) HDX or FDX ISO transponders.

HDX or FDX?

These are both ISO-approved electronic chip standards used in animal identification. They both have their own distinctive characteristics, as well as their own advantages and disadvantages. FDX is more sensitive to mechanical vibrations, whereas HDX is more sensitive to electronic interference. HDX has better read distances than FDX (approximately 15%), but is more expensive (approximately 15%).

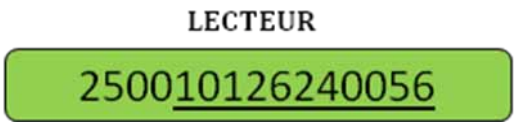
Although at this stage, no information suggests that one particular standard should be favoured over the other, several factors affect one's choice or the availability of both these technologies:

- the current competitive procurement system that the EdEs (regional livestock centres) use for ordering tags will logically give pre-eminence to FDX technology, which is less expensive. But this will not prevent applicants from ordering HDX-type markers.
- Some device manufacturers - particularly those involved in building automated equipment for, for example, milking - strongly recommend using HDX tags. Although the readers used with these automated devices should logically be sold in compliance with the ISO 11785 norm starting in July 2010, some readers which are already in use are not, and can only be used for reading HDX tags. Unless the owner is actually forced to change reader, this confirms the need to be able to order markers of this type. However, there will still the case of purchasing replacement lambs in a context in which FDX markers are preferable.

  It should also be remembered that although an ISO reader - in accordance with

- **Display and transmission of numbers read by the readers**

  Whatever its brand or model, the reader must be able to supply numbers in the same mode (number of digits, associated information, etc.) to the software or automatic equipment that makes use of them. Otherwise, the farmers or operators would not be able to change readers without having to modify the software or automatic equipment which processes the data.



  A standard for displaying and transmitting data is in the process of being validated by the ISO. This will be the 24631-6 norm, the publication of which at the end of 2010 will require manufacturers to agree on and standardise this particular feature on all readers.

4.4.2 Limitations of interoperability

In an entirely interoperable technical environment, a user should be able to change reader whenever they want without it affecting the software used to process the data - just as in an office environment, a printer can be changed without it affecting the word-processing software being used. Unfortunately, however, the technical constraints associated with the way in which the readers work does not currently allow this.
Although software used very often to be specifically designed to work with a particular reader, the situation has been greatly improved as a result of the pre-deployment projects.
However, any change in reader still has to be validated beforehand by the designer of the software used to process the data.

- **Impact on the distribution of readers**

  In the absence of greater standardisation for readers, it is only possible to guarantee that a particular model will be compatible with a given software application once it has been validated by the software designer.

  This means that software designers (of flock management programmes in particular) have to provide their clients with a list of the readers that are compatible with their applications and keep updating this list on a regular basis. Software designers could recommend - and even distribute and configure - readers for their clients (as they do with PDA solutions).

  The market has yet to settle, and so the roles of reader manufacturers and software developers have not yet been clearly defined as far as configuring the readers and providing technical support is concerned.

In all cases, it is important that users should only have to deal with one person.
Getting reader distributors and software designers to work more closely together and/or having all of these tasks taken care of by specialist installers is what is required if electronic identification applications and user services are to be properly deployed.

4.5 Integrating fixed readers and reading moving animals

The projects have demonstrated that some of the uses of electronic sheep identification (professional or regulatory) throughout the sheep sector have to involve fixed readers. How fixed readers are installed is fundamental in determining whether or not an RFID application is successful, particularly when speed is a major issue. It's important to ensure that they are integrated as well as possible into existing structures to ensure that data is read properly.

4.5.1 Sensitivity to environmental constraints

Fixed readers are extremely susceptible to interference from metallic and electrical environments (electromagnetic interference). This should be taken into account when installing them to ensure that they operate properly.
As such, pens and metal working chutes often have to be specially adapted. This usually involves replacing a metallic structure by a wooden or plastic wall so as to avoid interference with the readers.

The places which were found to be the most subject to interference during the pilot projects were abattoirs. A number of examples demonstrated that interference could result in low - or even zero - read rates (cf. the Vigeant-86, or Capdenac-12 abattoirs).
More detailed studies need to be carried out with reader manufacturers. They could develop solutions either by significantly modifying the metallic structures of the pens (improving earthing, for example), or by improving electrical cabling, or the reading equipment itself in order to work around these problematic situations.

Other environmental factors, such as humidity (ambient, as well as due to equipment being cleaned using high-pressure tools) should also be taken into account.

4.5.2 Sensitivity to human constraints and the way in which work is structured

At sites where the way in which workstations are structured is very well-defined and difficult to change without expensive investments (for example, on a slaughter line), choosing where to locate a fixed reader is very important.

Should the constraints be managed or should the reader be moved?

At certain sites where the environmental constraints are considerable, it could be decided to install the readers in better locations in order to avoid having to carry out major modifications to existing structures (pens or chutes) - given that most readers are located upstream of the route that animals' take as they move around the facility. This results in a system in which the cattle have to queue:

- in which several animals are positioned between the reader and the operator,
- which leads to a longer period of time between the numbers being read and the point at which they can be used.

Moving the reader further can prove to be the wrong decision, as it can interfere with the flow of animals and the way in which the operator's tasks are structured. Furthermore, the order of the animals could change during the period between the reading of the numbers and their being used, for example:

- in an abattoir, the removal of an animal from the line,
- in a milking parlour, animals which do not present themselves at the milking unit in the same order as the order in which they are read, if they are read at the entrance to the parlour

One factor in particular was highlighted at the Parthenay market: the need to dismantle and then reassemble - every time the market is held - the reading box in order to prevent the risk of theft. This results in the reading device's connectors being weakened - something which was not necessarily planned for in the device's design specifications.

4.5.3 Sensitivity to animal behaviour and the penning system

Because current technology does not allow several animals to be read at the same time, it is vital that they be read individually. For moving animals, they need to be made to move through a chute.

The pilot projects demonstrated that the quality of the penning system used, and the way in which it affects sheep behaviour, is a determining factor in optimising the quality of the reading and achieving a maximum read rate. It also has a significant effect on the speed at which numbers can be read: speeds can be doubled in certain situations.

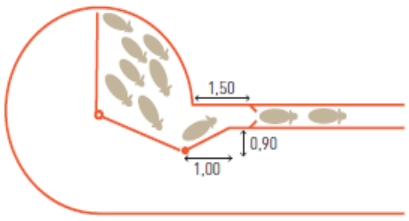
If the quality of the readers is improved, the penning system becomes the source of the bottleneck in drives to increase read throughput rates.

A number of factors should be taken into account:

- regarding the animal:
  - o differences in size and build between animals of different age categories (young animals, adults), leading to the widths of the pens needing to be modified,
  - o whether or not they have been trained to use the pens: animals which are accustomed to passing through chutes or penning systems on a regular basis pose fewer problems in managing the flow of animals. This is the case with adults or lambs that have been fattened collectively ("weaned" in the Roquefort area). However, this is not the case with suckling lambs that have been fattened on sheep farms. They are seen to display a number of significant behavioural problems at batching centres which use penning systems that are not specifically managed for them.
- regarding equipment:
  - o the quality of the equipment design when the animals have to pass through a reading system which integrates a penning system that traps them in (for managing read failures in particular). Poorly designed automatic door systems at entrances can either trap the animals, leading to operators having to intervene to release them, or they can allow two animals to enter simultaneously, rendering reading impossible. Time is always lost in such cases, and sometimes additional staff even have to be mobilised in order to manage these situations - situations that were encountered when testing certain devices as part of the projects.

    An alternative to the system involving the animals being locked in by opening and closing doors is a system which involves locking them in with a side pinching mechanism (vice). Only one manufacturer has developed an automated version of this system (cf. photo opposite). A number of manufacturers offer manual models.

  - o the quality of the penning system upstream of the reading device: the entrance leading to the chute must be designed so as to avoid bottlenecks. This requires continual intervention on the part of an operator. Similarly, systems have to be in place to ensure that animals move correctly through the chute (anti-return mechanisms, width appropriate for the size of the animals).
- Regarding the way in which the flow of animals feeding into the reading system is structured: interruptions in the flow of animals (batches of animals being introduced intermittently into the system) are a major factor in slowing down the read rate. Specially adapted penning systems ("cheese" or retainer systems) can attenuate the effects. This is not always possible in all cases (for example, and markets). Optimising the way in which the flow of animals is managed in order to maximise reading efficiency may involve significantly modifying the way in which the building and its equipment are laid out.



« camembert »

However, in new buildings, this installation constraint can be taken into account so as to optimise the way in which work is structured and so take advantage of electronic identification.

4.5.4 Managing read failures

Although the read rates measured were very high (often above 99%) and very encouraging, it is still not possible to:

- guarantee a 100% read rate in all conditions,
- and so completely eliminate read failure problems (even though they are very rare), the management of which can, in some cases, prove very problematic.

1. On farms

When technical management of flock is all that is required, read failures are not such a major issue as they are in situations which require a 100% number retrieval rate. A batch of animals can always be put several times through a fixed reading system (which may not include a stopping or animal sorting system - cf. sheet 1.3), or animals whose numbers have not been read can be caught later on. Farms are not subject to the same time and benefit constraints as batching centres, for example.

2. At collection centres

Managing read failures is crucial, and there are **three potential sources** of read failures:

- the absence of an electronic marker (red replacement tag or tag lost during transportation, or animal which has not been electronically processed during the transition period leading up to 2013),
- it not being possible to read the tag, for whatever reason,
- several animals passing in front of a reader at the same time as a result of the animals upstream of it having been improperly penned.

In all cases, in order to retrieve all numbers, there should be some sort of system to lock the animals in place.

If the rate at which animals are fed into the system is not too high, a manual sorting door can be used to manage them. Otherwise, if large numbers are involved, an automatic system is required that enables read failures to be isolated. If the read failure has come about as a result of a tag malfunctioning, the number can be read visually and then manually entered.

3. On a slaughter line

Managing read failures on slaughter lines is just as important as at collection centres, but the resources that can be put in place are usually more limited. If a fixed reader system is to be used to optimum effect, a presence detection system is required in order to alert the operator in the event of any animal on the chain not being read properly. Read failures can then be corrected manually.

4.6 Equipment cost

4.6.1 Reading equipment

For purchasing purposes, the prices publicly advertised by the manufacturers are as follows:

- Portable reader: €700 to €1000 plus tax for a simple reader (stick or box),
  €1000 plus tax for an "all-in-one" reader (integrated PDA),
- Fixed reader: €1500 to €4000 plus tax (including installation). The size of the antenna, how the reader is protected, and the way in which the power supply is integrated can all affect the overall price of the installation.
- Fixed reader combined with a penning system, scales and/or automatic sorting doors: €8000 to €15,000 plus tax, depending on options.

4.6.2 Associated costs

- PDA: €400 excl. VAT
- Bluetooth printer: €400 excl. VAT
- Flock management software: from €600 to more than €1000 plus tax
- Modification of the penning system (changes to the chutes or pens)
- IT development work to adapt software at facilities downstream
- Modifications to automatic equipment (repositioning readers, changing readers)
- etc.

For the purposes of weighing sheep at farms, a number of farmers can club together and purchase a reader and weight indicator (see topic 3).

4.6.3 Economic alternatives

Although regulations now require that equipment be purchased, new sales proposals are emerging.

A recent proposal offered by a service provider is based on 2 facts:

- the equipment needed for electronically reading tags and making use of the information acquired can be complicated to set up for most of the people likely to use it. They therefore need to be provided with complete systems that they do not have to worry about implementing.
- having to maintain the equipment and software is a major consideration for users who cannot - for lack of expertise and time - consult the manufacturer in question for each and every device or piece of equipment in use.

The proposal therefore involves providing an overall service which includes:

- provision of the reading equipment (fixed reader with weighing and sorting system, and/or mobile reader),
- transfer by GPRS (mobile telephone) of data read to a remote database and a facility for the user to retrieve their data instantaneously via a web browser on their computer. A programme is provided enabling users to make use of their data. This system avoids the need to synchronise the data saved onto a PDA with data on the PC,
- maintenance of equipment and software as soon as possible (within 24 hours according to advertised information).

The user enters into a contractual agreement whereby they pay a monthly subscription to the service provider which covers the provision of the equipment and software, and their maintenance. The cost of the subscription is based on the number of animals read on a monthly basis.

5 CONCLUSION AND OUTLOOK

Projects which met many of the objectives that were fixed at the outset...

- identification and resolution of problems to do with ordering tags as part of a future wider deployment of the system, resulting in:
  - improvements in the ordering tools for the EdEs (regional livestock centres), in the process of being finalised,
  - creation of procedures for implementing electronic processing and the means of communication which have to be used with them (technical sheets).
- analysis of the difficulties associated with implementing reading systems at farms (on the basis of mobile readers), which required and led to improvements in equipment (ergonomic design, configuration, etc.) and their interoperability (development of data exchange standards, etc.).
- testing of various configurations of reading equipment in different situations throughout the sector. This enabled companies to identify many of the benefits and constraints associated with using electronic identification, particularly with regards to future legislation requiring that individual notifications be generated for the movements of all sheep.
- communications drives carried out at both national and regional level (trade fairs, information meetings), drawing on documents and other aids that have emerged directly from the projects.

... with questions which still need to be explored for further phases in the projects.

- Because of the way the pilot and pre-deployment projects were organised (divided into regions that did not cover the whole country, farmers and operators taking part on a voluntary basis, the minimum number using RFID tags), specific questions about certain groups or geographical areas have remained unexplored (very large herds of sheep in the south-east, exportation of certain types of animals, small facilities, etc.).
- The lack of financing for software development meant that in most cases, it was not possible to test the data use chain (including individual notification) as part of the projects.
- The most suitable equipment for certain situations was not always available from the manufacturers (transhumance, etc.), or it was developed too late for it to be tested.
- The quality of the tags needs to be looked into in more detail, both in terms of the quality of production and their performance throughout the lives of the animals to which they are attached (reliability, robustness).

Different expectations depending on the stakeholders in the sector

Although electronic identification provides solutions which can be used on all types of farm, some applications are more directly suited for dealing with large numbers of sheep or for automated management. In this respect, electronic reading and making use of the data read should first start to gain in popularity on farms with large numbers of sheep.

Stakeholders involved downstream in the projects all expressed a keen interest in the use of electronic identification. But from their perspective, electronic identification can only be used if electronic tags are widely adopted. As far as they are concerned, a system in which animals that have been tagged electronically coexist with animals wearing traditional tags is of no benefit, as it would result in too many read failures.

The emergence of new equipment and service solutions provided by manufacturers, linked to more clarity on the market, driven by clearer regulations.

The equipment available from manufacturers changed little between when it was launched in 2005 and the end of the projects. This situation is now rapidly changing as clearer regulations are brought in and the market begins to grow.
These solutions involve both major improvements being made to the devices available, as well as better service, with the emergence - in particular - of the concept of after-sales service.

- *Towards completely integrated fixed solutions*
  Implementing automated solutions requires a combination of skills, and so involves various different businesses - such as those involved in identification, electronics, designing pens, automation and IT - all working closely together.
  Although these companies started working more closely together a number of years ago within the context of the pilot projects, their endeavours have rarely resulted in products that are fully developed from both a technical and commercial perspective - at least not in France. But this situation is now changing dramatically. It needs to, because users - particularly of complex devices - do not want to have to deal with a number of different contact people, all mutually refusing to accept responsibility in the event of a malfunction.

- *Towards other solutions for information and traceability systems?*
  An integrated GPRS-enabled mobile phone and reading device (portable or fixed) can be used to send back the information read in real time to a remote database. It can then be routed to other parties who will use it for their own specific purposes. This solution has already been adopted in a number of European countries for traceability systems. It should rapidly gain in popularity in France.

- *Alternative solutions for increasing reading speed?*
  One of the solutions being developed by manufacturers would involve using multiple readers. With these systems, animals' tags could be read in very wide chutes (compatible, for example, with the transfer bridges of lorries), without slowing down the movement of animals into or out of collection centres (markets, batching centres, abattoir sheepfolds) by avoiding bottlenecks.

RoyalTag device

ALEIS device

These types of systems were not tested during the pilot projects. It would be interesting to gather information on how this equipment is used and assess how it deals with the constraints associated with reading the tags of more than one moving animal, mainly for operators working downstream.

But it should be remembered that this type of system does not yet have a solution for dealing with read failures.

So it can only really be of benefit if all the animals moving through it have fully functional electronic tags. If one single animal does not have an electronic tag or has a tag which is not working properly, the benefits of reading the whole batch electronically are compromised.

The need to set up tools to monitor current and future devices

The pilot projects gave rise to questions that went unanswered or which were only partly answered. This, together with the new prospects that clearer regulations have created on the market (particularly for manufacturers), demonstrate that:

- work on improving penning systems needs to be continued to ensure that tags can be read without interference from the surroundings
  - a course on this topic is in the process of being put together at the Institut de l'Elevage which should result in an initial decision-making tool being developed for making choices about which type of reading system should be installed.
- work needs to be done on improving the speed and performance of reading devices:
  - theoretical and actual speed depending on different situations
  - comparison of equipment.
- farmers should continue to receive support in the deployment of electronic identification systems:
  - supervision of electronic processing operations,
  - light infrastructure needs to be developed in order to monitor users of electronic identification systems and provide them with support over a finite period of time (3 years).
- the quality of markers delivered and their performance need to be monitored on an ongoing basis with:
  - analyses being carried out with the Valence laboratory,
  - analyses being carried out with the Wageningen laboratory, (Netherlands),
  - the development of an ongoing retrieval protocol for markers.
- tools need to be implemented in order to:
  - both keep a watch on technology in the sector,
  - and test:
    - new identification aids
    - new reading equipment
    - new integrated sales offers

6 FOR MORE INFORMATION:

On the Institut de l'Elevage website: the electronic area

- information about the technology
- information on regulations (texts and communications documents)
- a glossary of terms used in electronic identification
- an up-to-date equipment catalogue
- the pilot and pre-deployment project report
- frequently asked questions
- communications aids
- eventually: a decision-making tool for installing a reading system

http://www.inst-elevage.asso.fr/html1/spip.php?page=rubrique_espace&id_espace=937&id_rubrique=294

Collection
Méthodes et Outils

Édité par :
l'Institut de l'Élevage
149 rue de Bercy
75595 Paris CEDEX 12
www.inst-elevage.asso.fr

Avec le soutien financier de :
Ministère de l'alimentation,
de l'agriculture et de la pêche
78, rue de Varenne
75349 Paris 07

Dépôt légal :
3e trimestre 2010

Juillet 2010
Réf. 00 10 78 017
ISBN 978-2-84148-915-2

Imprimé par :
Mail-Édit
68, rue de Charenton
75012 Paris

COLLECTION **MÉTHODES & OUTILS**

Electronic identification in the sheep sector

Final report on the pilot projects 2008-2010

In 2008, a number of professional organisations in the sheep sector, together with the Ministry of Agriculture, decided that an assessment was needed of how electronic identification (RFID) could be used in the sheep sector, together with a technical reference framework, to prepare the obligation of electronic identification in 2010. For that, a wide project of pre-deployment (on 6 experimental regions), was implemented to obtain technical references on the use of this tool in real conditions.
On farm-sites, the actions led served a means for acquiring data on retagging animals with electronic devices to prepare the implementation of compulsory electronic identification; and in the evaluation of the applications of the RFID for the flock software management. For the downstream operators of the sector, the tested applications focused on loading/unloading sheep at a collection centre, the use of portable readers by sales operators and boosting internal traceability at market places and slaughter-houses by entering the animal's number on the slaughter line.

INSTITUT DE L'ELEVAGE

Édité par :
l'Institut de l'Élevage
149 rue de Bercy
75595 Paris CEDEX 12
Tél. 01 40 04 51 71
Fax 01 40 04 52 80
www.inst-elevage.asso.fr

Juillet 2010
Réf. 00 10 78 017
ISBN 978-2-84148-915-2

AVEC LE SOUTIEN FINANCIER DE :

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'ALIMENTATION DE L'AGRICULTURE ET DE LA PÊCHE