Project n°.FOOD – CT – 2006 - 043134

Operational Management and Geodecisional Prototype to Track and Trace Agricultural Production

OTAG

Specific Support Action

FOOD

FINAL ACTIVITY REPORT

Period covered: 01/12/2006 to 30/11/2009

Date of preparation: 2010, February, the 9th

Start date of project: 01/12/2006
Duration: 24 months – extension obtained for 12 months until 30/11/2009
Date of the entrance into force of the contract: 3/04/2007

Project coordinator name: Gérard Chuzel
Deputy project coordinator name: Dominique Didelot
Project coordinator name: Cemagref

The electronic version of the Final reports is submitted as follows:

A complete file containing the **final activity report**: work, objectives, results and conclusions on the three years of the project.

A complete file for the **final management report**, including a summary financial report and a report on the distribution made after the end of the project.

A separate file with the **Annex on the Plan for using and disseminating** the knowledge

A separate file containing **the Publishable Executive Summary** for the whole period

Publishable executive summary

Project n°.FOOD – CT – 2006 – 043134

Operational Management and Geodecisional Prototype to Track and Trace Agricultural Production

The OTAG project is dedicated to **extensive beef production**. It has worked on the design of a system that monitors cattles through their environment, via electronic collars in order to manage the spread of diseases and to egional pasture use.

The OTAG project has two main objectives. Firstly, a geodecisional system is made operational under the controlled conditions to track and trace the mobility, provenance, and state of beef cattle using emerging geospatial and geocommunication technologies. Secondly, OTAG looks to improve innovative mechanisms and methods for recording reliable and accurate data on the origin and primary production of beef as well as the environmental conditions of the territory where the cattle are based.

Herd of cattle at the frontier between Brazil and Bolivia – Photo Emilio Ruz (Procisur)

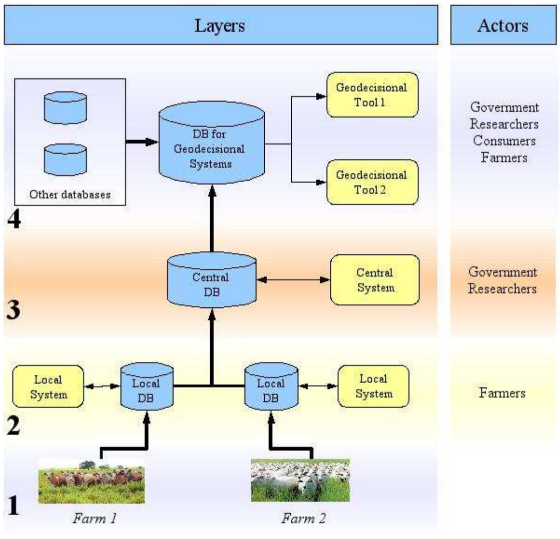
The prototype includes the use of GPS collars fitted to cattle and information systems based on geodecisional polygons. It has been tested in real conditions at an Embrapa experimental farm in Brazil. The main challenge is to integrate the different levels of data and functionalities in order to obtain a user tool that is easy to use.

The innovative system is the result of European, Canadian, and Brazilian expertise and relies on a combination of existing operational systems, precision geoinformatic tools and experts and user groups from Southern Cone Countries, Canada, and EU.

A central aim of the system is to demonstrate a supporting system for the **management of emerging risks in beef production.** Southern Cone countries understand that traceability is a tool that, by means of a suitable identification of the cattle, contributes to the improvement in the information on stocks of cattle and to a useful knowledge on the dynamics of the national livestock, allowing an improvement of the national sanitary system. **For example, the Brazilian beef production** spreads over a large extent of land, including approximately 225 million hectares distributed in 2.2 million properties, according to the Brazilian Institute of Geography and Statistics (IBGE), and a population of 165 million of animals, according to Anualpec (2006). This is a productive chain responsible for 7.2 million jobs (IBGE, 2003). The bovine meat agribusiness has been growing annually in Brazil on a competitive basis. During the last decade, the medium growth was approximately 30 per cent, while the growth of the exports was higher than 200 per cent.

Aiming to meet the requirements of the European Community beef traceability systems, the Ministry of Agriculture, Livestock and Supply (MAPA) established the Brazilian System of Identification and Certification of Cattle and Buffaloes (SISBOV). According to SISBOV, it is required for the producer to ensure animal identification and to keep a record of the livestock management. For animal identification, the following devices are allowed: ear tag and brand of fire, ear tag and tattoos, ear tag and button, ear tag and electronic devices – always used in pairs. It is however, egionaliz that traceability using electronic devices, readers, and labels, is understood as the safest way for effective tracking and tracing.

The OTAG prototype



Computational architecture of the OTAG prototype

The computational architecture proposed for the OTAG prototype is **organized in four layers.**

Layer 1 relates to the data collection from electronic devices in the paddock. The animals have a necklace with a GPS device and the paddock has sensors for automatic collection of weight, vaccination register, and temperature measurement of each animal. The informations produced by the electronic devices are sent to a computer located in the farm headquarters. For this task, the open standard XML is used, making it possible for any manufacturers to use the electronic devices. In fact, to define and to improve a standard that can be used by any manufacturer is one of the challenges for the OTAG project.

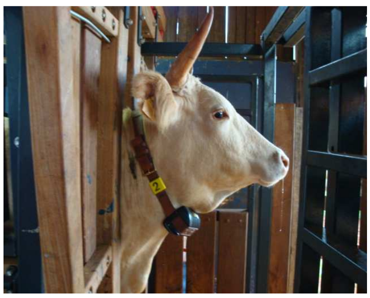
Layer 2 is responsible for storing data, which is sent by the electronic devices and associated with farm management data. The user interface of this layer will allow the farmer to manage data and to extract reports about his cattle production via the Internet. The data of each farm will be sent to layer 3 by using web-service technology.

On layer 3 the information of all the farms of the OTAG system are joined in the same database. Thus, the information concerning to animal movement inside a farm and between farms can be analysed by the use of techniques for dealing with georeferenced information.

The last layer is responsible for treating the data from the OTAG database and from external databases (ground, pastures, climate), and joins them in a specific database to allow geo-decisional analyses.

Development of electronic collars

One of the objectives of the OTAG project is to track the displacement of animals in natural and extended environments.



Implementation of electronic collar on animals in Brazil -EMBRAPA station of Campo Grande – Mato grosso do sul – Brazil

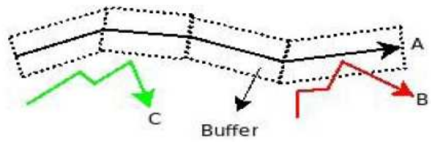
Figure on collar and base station system

The project has developed a strategy called the 'individual-based' approach. One of the most original points of the OTAG system is the fact that GPS positions are periodically and automatically transferred to a base station in order to be collected and used by the management system.

Both hardware and software have been developed for the OTAG project to track and trace cattle. The system works via a collar that is placed on every animal, which uses an internal GPS to measure its position with a predefined frequency. Then the GPS data are transferred to a base station. The role of the base station is to collect the GPS data from all collars and make them available to an operator.

Geospatial tools will be developed to monitor and to avoid new foot-and mouth (FMD) outbreaks. The experiment with the collars at the Embrapa Beef Cattle farm created a need to show the animal mobility data collected in the experiment. This led to a web application based on open source tools, integrated with geotechnologies defined in the OTAG Information System Architecture and fully capable of displaying vector, raster, and animal mobility data.

Designed to re-instate status



In project OTAG, one of the demands is to identify the contacts between animals, inside of a time period and considering an area for the animal movements. In a case of a foot-and mouth disease (FMD) occurrence, for example, the identification of these contacts can help to determine which animals could have some interaction with some contaminated animals. From the current localization of the contaminated animals, it is possible to manage the action of the sanitary authorities better, as well as isolating better producing regions, to minimize the scattering of the illness.

FMD is still a challenge for Brazil, because economic and sanitary barriers prevent the access of Brazilian meat to new markets. In 1992, the eradication programme with □egionalized strategies in accordance with the livestock production systems and agribusiness actors was implemented causing the elimination of outbreaks after 2001. However, in September 2005, a FMD outbreak occurred in the States of Mato Grosso do Sul and Paraná, and then, due to emergent risks, the states of São Paulo, Goiás, Mato Grosso, Federal District, Tocantins, Minas Gerais, Rio de Janeiro, Espírito Santo, Bahia, and Sergipe lost the status of 'FMD free zone with vaccination'. They were therefore forbidden to export meat to other countries. The loss related to the return of the FMD disease in Mato Grosso do Sul, could have reached US$ 1,5 billion, due to commercial restrictions to the main exporters. Since then, Brazilian's authorities have been taking sanitary measures to reestablish the status of 'FMD free zone with vaccination'. Thus, one of the relevant issues to assure the 'free zone with vaccination status' is to maintain appropriate sanitary conditions, together with permanent monitoring procedures.

Next steps of the project

Three Embrapa centres that collaborated in the OTAG project are formulating an internal project proposal, inviting private sector partners to advance the prototype technologies to commercial uptake levels. The ambition is to develop 'public-private' partnerships in order to disseminate technological innovations. So, OTAG Collar technology developed in France is planned to be exported to Brazil and Argentina.

In the R&D field, Procisur together with INTA-Argentine is designing appropriate documentation and detailed descriptions of systems and technologies (+ the various physical prototypes) in order to introduce these into several research laboratories that have expressed interest in experimenting with the system for other research purposes. This information will also be shared, through the assistance of Procisur, with the agricultural national research institutes in Chile, Uruguay, Paraguay and Bolivia.

Partnership with Canadian, French, Brazilian and Argentinean researchers was an additional beneficial effect of the OTAG International partnership.

Public website: http://www.otag-project.org

- Deputy project coordinator: Dominique Didelot (Dominique.didelot@cemagref.fr).

2010, February, the 8th

Section 1 – Project objectives and major achievements during the entire period

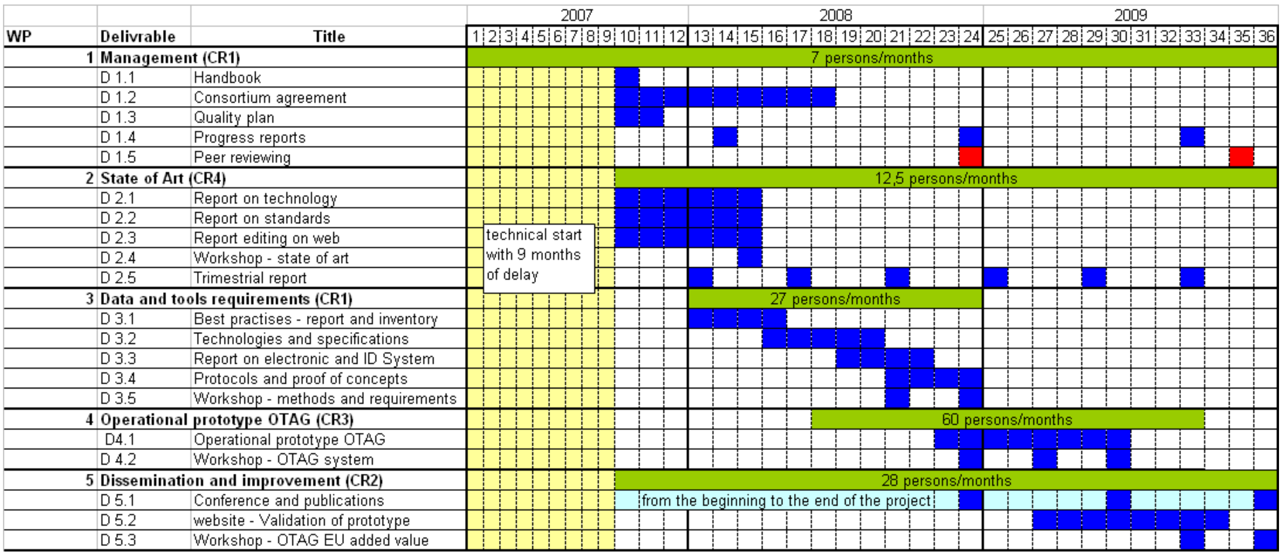
The effective start of the project took place with a 9 months delay compared to the theoretical date of departure (1st December 2006), reflecting a late signature of the contract on April 3, 2007 and a payment, and transfer of funds on partners only in September 2007. The consortium held its kick-off meeting in March 2007 in Campinas, Brazil.

After taking care of all the administrative procedures and a challenging task due to the mandatory translation of documents in the different languages of the project (Portuguese, English, and French), the coordination has been strengthened since November 2007 with the arrival at CIRAD Sao Paulo of a VIA (Volunteers International in Administration): Fanny Lange, who was devoting 20% of her time on assistance on the project. Her presence in the field, close to the operational teams of Embrapa has greatly increased the efficiency of joint work.

After workshops of November 2007 and March 2008, we have adjusted the timing of operations as follows, but in respecting the main planned deliverables:

I remind that the work on the OTAG project has been divided into 5 workpackages:

WP1: Project management
WP2: State of the art
WP3: Data and tools requirements
WP4: Operational prototype OTAG
WP5: Dissemination and improvement



The first period (2007), shortened in technical activities, has anyway led to the publication of the report due at 6 months of WP2 on the state of the art on the traceability of cattle and tracking technologies (see summary in the first activity and scientific reports).

The second period (essentially on 2008) has been concerned by the WP 3 on "data and tools requirements". Some operational implementations relative to WP4 "operational prototype" have been also developed on this second annual period. So, the main objectives for this report period have been defined during the workshop of March 2008, held in Campo Grande Embrapa center.

- ☞ to set-up "Information systems" requirements and to design IS architecture
- ☞ to design innovative "electronic collars"
- ☞ to implement classical GPS readers on existing identification RFID devices, already available on Campo Grande experimental farm and designed by Embrapa
- ☞ To further in more details the PhD thesis objectives of Thais Basso Amaral.

On point 1 about "Information System work", Campo Grande workshop of March 08 has highlighted the really good team spirit that could be put in place between Embrapa (IS team), CIRAD and Cemagref (IS team). The contact was so good that the group decided that Cemagref of Clermont-Ferrand (JP Chanet) was going to welcome and receive two researchers from Embrapa: Marcos Visoli and Sonia Ternes during spring and summer 2008 for respectively 6 and 3 weeks, in order to build together IS architecture and to study a longer research stay for both of them. The results has been a registration in IS Master of Clermont Ferrand university for Marcos (beginning in November 2008 with JP Chanet supervision – the end in August 2009) and a post-doc for Sonia in "complex system modeling" team of Clermont Ferrand Cemagref (supervision of Guillaume Deffuant) during all the 2009 year – Obviously, their subjects have been defined in consistency with OTAG targets.

On point 2 about "electronic devices", the main competent team belongs to Cemagref of Clermont-Ferrand (around Patrice Faure), in link with operational implementation with Embrapa of Campo Grande (around Pedro Paulo Pires). Cemagref team has reminded that initially, the "electronic devices design" was planned on 18 months work. To reduce to 10 months work in order to be compatible with project duration, it's necessary to reduce some parts of designing. One technician (Philippe Rameau) works nearly full time on this task. According to GPS prices which are now really cheap, they decided to design a unique model of electronic collar which can be used as "master collar" or "slave collar" in function of experiment needs. The first operational results had been ready for the Steering Committee meeting in December.

On point 3 about "GPS readers", it was a collective idea which has emerged during Campo Grande workshop. As Embrapa team of Campo Grande (around Pedro Paulo Pires) has already developed RFID identification system on bovine herd, we could couple this system with GPS readers implemented on some water points or control locations to begin collecting mixed-datas (RFID and GPS) for helping IS design. So, this operation is a partnership between two centers of Embrapa: Campo Grande and Campinas.

The point 4 concerns a PhD thesis led by Thais Basso Amaral (researcher of Campo Grande center). The general subject has been identified since the launching of the project, between Embrapa, Laval University of Quebec (Dr Alain Viau and Dr Matthew Hatvany) and Cirad (Dr Valery Gond based in Laval University). As Thais Basso Amaral is a veterinarian research fellow, the work objectives have been defined essentially around risk assessment of bovine disease. The added value during her Ph.D came from the spatial analysis of the risk assessment. Her registration in Geography Department of Laval University has helped her work in relation with Professor Mathew Hatvany. She was involved also in the management tools using remote sensing techniques (Gond and Viau). Because of the distance and administrative problems (visa, University registration), the PhD really began in September 2008 instead of May or June 2008. Her installation in Québec and at the University was correctly manageddone by Cirad during the end of the summer. Thesis objectives have been discussed during the workshop of September 2008 in Quebec and are presented in details during the steering committee meeting in December 2008 at Clermont-Ferrand.

The third period (essentially on 2009) has been concerned by the WP 4 about "Operational prototype" and the WP 5 about “Dissemination and improvement”.

So, the main objectives for this report period have been defined during the Steering Committee meeting and annual public conference of December 2008, held in Clermont Ferrand.

- to finalize the Information system architecture
- to test the electronic collars
- to go further with the PhD thesis objectives of Thais Basso Amaral
- to disseminate the knowledge produced during the project

On point 1 about Information System architecture, the Master’s thesis of Marcos Visoli, held In Clermont-Ferrand’s Cemagref center within the Information System team has been very successful. He proposed a data model for animal trajectory, algorithms for contact identification between animals, and a way to determine the disease contamination level.

On point 2 about the test of the electronic devices, the collars and base station have been tested in Campo Grande, under controlled Brazilian conditions, in March 2009. Because of some technical problems, the electronic devices have been sent back to France for revision and building of more exemplars. The idea was to be able to realize a demonstration day with more collars, in Argentina during the final conference of the project in September 2009. Finally, this plan was respected.

On point 3 about the PhD thesis led by Thais Basso Amaral, the general objective, specific objectives and methodology have been clearly defined since December 2008, and after a phase of field work in June-July 2009, some results have already been presented during technical and scientific conferences.

The point 4 concerns the disseminating of the knowledge. Different products have been elaborated in order to reach a large range of audiences: general audience, researchers, professionals, national sanitary services, etc... especially during the last conference of Mar Del Plata (Argentina) in September 2009. It's remarkable to mention a synthetic booklet produced by PROCISUR at the end of 2009, in order to prepare a following for OTAG.

Globally, the actors respected the objectives and deliverables. The coordination observes some shifting and slowness due to communication difficulties (to organize non physical meetings – time difference - …), administrative problems and some difference in expenses categories

Section 2 – Objectives – work and results per workpackage

➢ WP1 : Project management:

To remind the initial project expectations, see thereafter:

Objectives
To provide the administrative and financial management of the whole project.
• To provide strong management and monitoring of all the work undertaken during the project.
• To ensure that all the work undertaken by the project partners is of a high and consistent standard and quality.
• To provide liaison with the EC on behalf of the project consortium and the steering committee.

Description of the Work
T1.1 - Administration and Finance - The project coordinating partner will undertake this role in line with EC contractual requirements.
T1.2 - Management structure and techniques - A management structure will be created and documented in the Project handbook, consortium agreement & IP.
T1.3 - Project reviews and reporting - Formal project reviews will be scheduled and periodic progress reports will be produced every 8 months.
T1.4 - Scientific & technical co-ordination & reporting - Workpackage and Task leaders will be appointed for each WP and Task within the Work plan.
T1.5 - Quality Assurance & Management
T1.6 - Set-up, manage and maintain a project Web site – both for internal project use and public accessibility

Deliverables
D1.1 - Project Management Handbook (M10);
D1.2 - Consortium Agreement (M18);
D1.3 – Quality Plan (M11),
D1.4 - Progress reports for M's 14, 24, 33; Annual Report in M12, M24 ;
Final reports (M36)
D1.5 – Peer reviewing M24 and M35

It seems necessary to emphasize the administrative problems caused by this type of bi-regional projects. In addition to the transfers of funds which induced 9 months delay at the beginning, the Embrapa (principal partner) has succeeded to identify a budget line dedicated to the OTAG project expenses only in March 2008. Embrapa has contracted with a Brazilian foundation (Funarbe), which manages the specific budget of this project. This explains why the respective "form C" is empty for the first year, although technical activities already started.

We can do some specific comments on some deliverables:

- ☞ **The handbook** was available during the first period (sent to the commission at the same time that the first activity report). It was the "Bible" of project working. The governance requirements have been respected, in particular by helding systematically every month a phone conference (by skipe) between the members of the management team (Dominique Didelot from Cemagref, Mateus Batistella from Embrapa, Valery Gond and Fanny Lange from Cirad). The project assistant, Fanny Lange, wrote on the same day a report of this meeting, reviewed by the other members of the management team and then sent to all the actors of the project, but also uploaded on the intranet of the OTAG website in order to allow an easier access to these documents for everybody.

- ☞ **Consortium agreement** has been built on the base of classical ones, suggested by the European Commission. This specific agreement draft has been established in spring 2008 and 3 months were necessary for content acceptance. At the same time, we have observed that for signing a banal financial agreement between Embrapa, his financial delegated organisation: Funarbe and Cemagref, it needed one year (Embrapa has funds availability only in May 2008). So, to obtain the agreement of all the juridical services, we were afraid of the time that it would have taken. As we knew that this kind of agreement is not compulsory for SSA projects, we decided, through an "Executive committee" virtual meeting in August 2008, to adopt this version of the consortium agreement, but without official signatures. It was available on the website-intranet.

  The quality plan is managed with communication procedures. The intranet was managed by the project assistant from Cirad (Fanny Lange) and Embrapa who regularly uploaded documents in order to share them with all the members of the project. Steering processes using external members and other governance committees were described in the handbook. The official Steering Committee has been established with 4 expected external members: a traceability specialist of Ispra JRC who is Dr Fiore – a Brazilian bovine production specialist who is Dr Kepler - our EU scientific project officer – and we expected also another bovine production specialist, from out of Brazil who has been solicited by Procisur for the final conference.

  Initially, we expected to organize a regular "headmen conference" by using telephone collective system. But, it seemed difficult because of the very busy personalities involved in this project and the size of the project perhaps which doesn't justify this discussion scale.

- ☞ **The Peer reviewing** was managed through 3 networks: first of all, we had regular technical workshops: May 2007 – November 2007 – March 2008 – September 2008 – December 2008 (at the same time that steering committee) – June 2009 – September 2009 (final steering committee). For the Quebec one (September 2008), the organisation committee had invited external operators as ATQ (traceability Quebec) and other institutions involved in traceability. Secondly, the large diffusion of the newsletter was an opportunity to collect some questions, opinions and to make contacts. Valery Gond, the scientific coordinator and Fanny Lange, both from Cirad were in charge of the edition and the publication of the newsletter. After each workshop, they collected a few articles written by different actors of the project on the last subjects that were worked on. The newsletter were written in English, illustrated and sent by email to a diffusion list (project members, scientists and researchers, professionals interested in OTAG thematics,...). Thirdly, there is one official reviewing each year by organizing the *official Steering Committee* (in December 2008 and September 2009)..

In order to make the general coordination easier, **Embrapa setted up a website** in which can be still found the organisation diagram, the project presentation, and a list of the project products (seminars, reports, articles, publications, etc.). The project website is still controlled by Embrapa (Anderson Soares) up to one year more and before being welcomed by Procisur (this decision has been taken during the final meeting of September 2009).

The first **newsletter** has been available after the working group meeting in Campo Grande in March, 2008. The second one was published in November 2008 and the third one in August 2009.

A flyer was designed by PROCISUR taking into account the public information available on the OTAG website. It was elaborated in English and each participant has worked on the translation to each language (Spanish, Portuguese).

In addition to the individual or collective scientific and technical publications, PROCISUR has coordinated **the edition of a leaflet** which presents in 2 pages the main results (available during the final conference) and **a booklet** of 50 Pages, which gathers vulgarisation's articles written by all the partners.

- **WP2: State of the art**

To remind the initial project expectations, see thereafter:

Objectives
To identify opportunities and research gaps related to geodecisional tools used to manage risk and crisis events in beef production in the context of Southern Cone Countries and the EU policies. Run an accurate State of the Art survey in different Countries, collecting relevant information from any concerned field (regulation, research, standard, technology, ...). The survey will assess:
• Laws and local regulations in relation to EU regulations;
• Aims of the current crisis management in bovine sector;
• Approaches of the current risk management system implementations (papery vs. electronic media and emerging technology);
• Relevant methods and innovation.

Description of the Work
T2.1 Design and common outline. The task will design the instruments to ensure an effective, usable and homogeneous, review of the state of the art, taking into account the multi sector investigation and the international scope;
T2.2 Per-country review will be done for EU, South Cone Countries and North America;
T2.3 International and EU technology watch will be done;
T2.4 Technological and standard review. Assessment of the variety of geospatial and TI technologies that (can) take part to a geodecisional system, e.g. for cattle identification, cattle mobility, data recording and transmission, etc, also having a look at emerging technology and standard trends;
T2.5 Merging and report editing. On the basis of the previous tasks, data from different Countries will be merged and a comprehensive state of the art review will be issued;
T2.6 Accomplish a continuing technology watch;

Deliverables
D2.1 Report on the technology watch (M-15)
D2.2 Report on technologies and standards (M-15)
D2.3 Merging and report editing on the OTAG Intranet (M-15)
D2.4 Workshop on state of the art (M-15)
D2.5 Trimestrial report on technology watch (M-13, M-17, M-21, M-25, M-29, M-33)

The essential of the work was done on the first period (first year) and "state of art" has been published on the website. It was the basis document for the reflexion about how to implement the prototype.

To have more details on "state of art", see the Scientific and technical periodic report – period covered: 01/12/2006 to 30/11/2007

The point about trimestrial **"technological watch"** has been put in place in September 2008 through a specific recruitment by Procisur. An example of the regular reports on technology watch is available in the first scientific and technical report. It consisted in a bibliographic review of the existent technologies, regulations, consumer concerns and socio-economic aspects in relation with traceability. The report was based on the analysis of huge sources of information available on internet. Then, the information was processed and turned into a bibliographic file showing the essential information.

To have more details on an example of technology watch, see part D 2.5 – pages 2 to 5 of the Scientific and technical periodic report – period covered: 01/12/2007 to 30/11/2008

Two reports have been produced; they are available on the intranet, but we can't really consider that the objective has been fully reached.

During the workshop of March 2008, a discussion has been held about the "remote sensing" use and social issues, especially on acceptability of these innovative technologies by end-users. The point on "remote sensing" was convergent with secondary objectives of Thais PhD thesis and has been partially integrated in thesis methodology. But on the second point on "social issues", collective feeling has concluded that Thais PhD thesis could't take into account these aspects, even if everybody understood the importance of this field for dissemination of new technological systems. A realistic assumption for an other PhD thesis or Master's studies was emitted.

To have more details on Thais PhD thesis (Embrapa with University Laval at Quebec), see pages 10 to 18 of the Scientific and technical periodic report – period covered: 01/12/2007 to 30/11/2008.

➢ WP3: Data and tools requirements

To remind the initial project expectations, see thereafter:

Objectives *To identify the best practices requirements to track and trace emerging risks in beef production specifications in Southern Cone Countries and to rank priorities for suitable geodecisional systems.*

Description of the Work *T3.1 Make the inventory of the current practices in beef production and risk management in Southern Cone Countries;* *T3.2 Identify related specifications for best practices vis-à-vis local and EU regulations as well as market issues (import and export);* *T3.3 Evaluate geomatics and emerging technologies requirements and specifications to manage bovine sanity and mobility in the Southern Cone Country;* *T3.4 Define the requirements for data integration, architecture and system interoperability;* *T3.5 Adapt existing operational tools for OTAG System;* *T3.8 Design the protocols and proof of concept of OTAG System base on EU and Quebec ATQ operational tools.*

Deliverables *D3.1 Report on the inventory of the best practices (M-16)* *D3.2 Technologies and specifications for OTAG geodecisional system (M-20)* *D3.3 Reference report on field electronic system for identification and remote monitoring of bovine sanitary condition (M-22)* *D3.4 Protocols and proof of concept for OTAG system (M-24)* *D3.5 Workshop on methods and requirements (M-24)*

In conformity with the fact that JP Chanet manages "IS Cemagref team" and has supervised common work with Embrapa about this skill area, he had accepted to take the coordination of this WP3.

The main strength of the year 2008 for WP3 was the collaboration between Embrapa and Cemagref: Two researchers of Embrapa spent 2 months at Cemagref in June and July (M. Visoli & S. Ternes). M. Visoli had started a research Master in computer science at the Blaise Pascal University in November 08 in link with the Cemagref Information System team and finished it in August 09. S. Ternes had begun a Post Doctoral period in January 2009 at Cemagref in the LISC Laboratory and finished it in January 2010.

The work realized in 2008 was focused on two main topics: the conception of the information system and the design of electronic devices for automatic data acquisition.

The information system

Based on the inventory of the current practices in beef production and risk management in Brazil, the Brazilian regulations as exported market and the EU regulations as imported market, the requirement analyses and the computation architecture were made and presented in Campo Grande workshop (March, 2008), and were validated by all the project partners.

The architecture of OTAG prototype was presented in March, 2008, during the 1st OTAG workshop at Campo Grande, Brazil. During the 2nd workshop held in Quebec in October 2008, the team of Embrapa Agriculture Informatics presented a review of the general architecture of OTAG system. It was decided to include a new layer for treating the data from OTAG database and from external databases (ground, pastures, climate), and join them in a specific database to allow geo-decisional analyses. All project partners validated that new layer.

From the first one to the second workshop (Quebec, October 2008) the information system team defined the protocols and tools to be used for developing the local system. The technological framework is: Java 2 Enterprise Edition Platform, IDE Eclipse, PostgreSQL and PostGIS as database systems with geographical support, Hibernate tool as the persistence layer, Java Server Faces for interface design and control, Apache web server and Jakarta Tomcat application server.

At the same time, the UML model for the local system was developed, presented and validated at Quebec workshop. Since this activity was in the interface between WP3 and WP4, it is explained as the work done in WP4. The local information system was under development at Embrapa (WP4).

To have more details on work of Cemagref and Embrapa on "information system architecture and a geospatial data presentation layer", see part D 3.2 – pages 19 to 38 (in two papers) of the Scientific and technical periodic report – period covered: 01/12/2007 to 30/11/2008

The work achieved during 2009 was focused on the definition of data model for animal trajectories in the information system and the field experiments. Theses works were led within the framework of the master thesis of M. Visoli. He spent 10 months in Cemagref's Laboratory in Clermont-Ferrand to follow his Master in computer science with success.

No specific difficulty has been met for the Information system setting-up and proof of concept.

The results were presented at the different meetings of the project. Several publications have been made in international conferences and a book chapter has been written on the information system and the model of trajectories.

For the detailed content of these deliverables, a first part is included in the second scientific and technical report (field electronic system design, ...) and from D3.4 (linked with D4.2) , see the 3rd scientific and technical report sent with the third activity report (page 36 of this report).

Electronic devices

The second main topic of this WP3 was the development of electronic devices to make automatic data acquisition (collars, base station and GPS-RFID couple: read WP4 part). Two kinds of device have been developed:

i) collars to follow animal in pasture

To have more details on work of electronic team in Cemagref, see part D 3.3 – pages 39 to 59 (in two papers) of the Scientific and technical periodic report – period covered: 01/12/2007 to 30/11/2008

ii) RFID station to make measurement on animal.

All the devices are localized with GPS, so all the registered information is geolocalized. The demonstrator on RFID use is located on Campo Grande’s Embrapa experimental farm

To have more details, see part D 3.1 – pages 5 to 9 of the Scientific and technical periodic report – period covered: 01/12/2007 to 30/11/2008

Scientific and technical production (Paper – conference – prototype – software)

***Publications*:**

[1] M. Visoli, J.P. Chanet, F. Pinet, et S. Bimonte, “Uso de trajetórias na rastreabilidade bovina,” *SBIAgro'09*, Viçosa, Brazil: 2009, p. 5.

[2] M. Visoli, S. Ternes, F. Pinet, J.P. Chanet, A. Miralles, S. Bernard, et G. De Sousa, “Computational architecture of OTAG project,” *EFITA 2009, Wageningen, NL 6-8 juillet 09*, 2009, p. 8.

[3] M. Visoli, S. Ternes, J.P. Chanet, F. Pinet, A. Miralles, S. Bernard, et G. De Sousa, “A new information system for tracing geolocations of bovine cattle,” *Atelier Systèmes d'Information et de Décision pour l'Environnement, INFORSID 2009*, Toulouse, France: 2009, p. 11.

[4] M. Visoli, S. Bimonte, S. Ternes, F. Pinet, J.P. Chanet, “Towards Spatial Decision Support System for Animals Traceability” in *Computational Methods Applied to Agricultural Research: Advances and Applications,* Ed. Hércules Antonio do Prado, Alfredo José Barreto Luiz, Homero Chaib Filho, *(Accepted, to be publish)*

***Thesis**:*

[1] M. Visoli, “Trajectory data model and algorithms for bovine traceability and disease contamination”, Master Thesis in Computer Science, University Blaise Pascal, Clermont-Ferrand, France, 2009, 45p.

Softwares:

[1] Information system for the storage of information

Reports

Ternes, S. & Visoli, M. C. – 2008 - An overview about thebrazilian systems Sisbov and GTA, Internal Technical Report n°1 of OTAG Project, 8p.

Marcos, M. C. & Ternes, S. – 2008 - A proposal for architecture of the Otag prototype, Internal Technical Report n°2 of OTAG Project, 9p.

Ternes, S., Visoli, M. C., Amaral T. B. & Pires, P. P. – 2008 - Electronic Devices and Conceptual Model of Local System, Internal Technical Report n°3 of OTAG Project, 12p.

Bernard, S., Rameau, P., Chanet, J.P. & Visoli, M. C. – 2008 - Data generation for information system design, Internal Technical Report n°4 of OTAG Project, 10p.

Visoli, M. C., Ternes, S., Miralles, A., Chanet, J.P., Pinet, F., de Souza, G., Pires, P.P. & Amaral, T.- 2008 - UML Model of the OTAG local system, Internal Technical Report n°5 of OTAG Project, 8p.

Visoli, M. ; Ternes, S.; Chanet, J.P. ; Pinet, F.; Bernard, S.; Souza, G.; Miralles, A. – 2008 - OTAG information system, Internal Technical Report n°6 of OTAG Project, 15p.

Demonstrator

- Collars + base station – 2008
- RFID Reader & GPS Station – 2008

➢ WP4: Operational prototype OTAG

To remind the initial project expectations, see thereafter:

Objectives

Design and implement the operational geodecisional prototype system base on the best practices requirements to track and trace emerging risks in beef production specifications for Southern Cone Countries.

Description of the Work

T4.1 Setting-up procedure and outlines. Definition of methodology and tools for the prototype, ensuring the capability to be operational (under control condition – Campo-Grande).

T4.2 Setting-up the demonstrator for the case study.

T4.3 Case study. Data collection and specifications as defined in WP3 by assessing:

- *The technical specifications for the system;*
- *The information system structure and function (architecture, analysis and processing functions, data integration…);*
- *The relationship between actors in the beef production sectors;*
- *The System usability, costs and impact on the organization(s);*
- *The enforcement of the system: mechanism, advantages, interoperability and limitations.*

T4.4 Final analysis with real case, defining similarities and differences in wide scenario.

Deliverables
D4.1 Operational prototype (M-30)
D4.2 Workshop and OTAG system bench marking (M-30)

Embrapa has taken the leadership on the development of the Geodecisional System for OTAG (WP4). The close interaction among Embrapa and Cemagref researchers has produced the necessary means for such to be operational by the end of the project.

Electronic devices

A first version of electronic devices was tested in March 09 in Campo Grande (Brazil): these first tests revealed some problems on the collars with energy consumption. A second version of the equipments was designed with improvement on hardware and software to decrease the energy consumption of the devices. Experimentations took place at Montoldre (France) in July 09, then at Campo Grande in September 09 with success. The equipments have been presented in real conditions at the final SC Meeting at Balcarce (near Mar Del Plata in Argentina).

The prototype and the results were presented at the different meetings of the project.

Prototypes:

[1] Wireless base station for collar data acquisitions / [2] Collars for bovine movement registration / [3] RFID Reader + GPS acquisition system

The opportunity of writing a patent on the collar development is studied by the Cemagref electronic team.

Report:

P. Faure, R. Rouveure, L. Moiroux, P. Rameau, "Electronic collars to track cattle – Manual of use V2", Technical report Cemagref, 2009, 23p.

The information system

So, by coupling with "information system" work (described in WP3), this full system prototype is composed by *an acquisition layer*, a data management layer, and a spatial decision support layer. The originality of this work is to envisage a new generation of traceability systems where the different locations are automatically recorded several times per day for each animal.

The acquisition layer allows measuring the animal geo-localizations in the pastures, using electronic devices embedded in necklaces carried out by animals. In the ***data management layer***, data are centralized in a spatial database that includes information about the production system, animals and their movements. The ***spatial database*** allows consumers, researchers, farmers and government employers to manage, query and analyze data related to bovine production and movements. In particular, these records constitute a valuable information source for providing an efficient traceability of animals, and retrieve all associated thematic information. As a consequence, the spatial database can be used as a support for a better sanitary control, and a reliable product quality system.

These systems should also be coupled with analysis techniques to help decision makers to take decision, validate and reformulate their hypothesis.

A data generator was developed to evaluate the system. The objective of this generator was to produce large amounts of data, while the locational devices are being developed in the context of OTAG project. With the generated data, we were able to evaluate the system in terms of volume and performance.

Every simulated hour consists on writing the position of each master collar and the list of detected slaves. Its CPU consumption is very small due to PostgreSQL / PostGIS performance.

The concept of a module inside the prototype dedicated to presenting data contained in the geodecisional database has been incorporated on the architecture later, when the need to represent geospatial information was foreseen.

The proposed module should make data and information available not only to the prototype client application, but also for other applications, not designed to directly access the database, but which could also benefit from the information available. To reach this goal, our team decided to use open standards, universally accepted for data interchange, such as: Web Map Service (WMS), for the production of maps from georeferenced data; Web Feature Service (WFS), used for the exchange of geographic information through electronic networks; and Keyhole Markup Language (KML), developed by Keyhole Inc. and used in Google Earth, subsequently accepted as a standard by the OGC. The three standards are based on Extensible Markup Language (XML) schemes and sent by Request/Response messages using the HTTP protocol.

Geoserver was also chosen to follow the specifications defined for such layer. Geoserver is a Java implementation that enables the publishing end editing of geospatial data. It allows publishing data in most currently available formats, using open standards. The entire management of Geoserver is done through a graphical Web interface. This provides quick and easy information management and availability.

The new layer for treating the data from OTAG database and from external databases (ground, pastures, climate) to allow geo-decisional analyses has been put in place after the workshop of October 08. Layers about biophysical variables, such as pasture type, soil characteristics, and water courses can be available through Geoserver using the same interface. Thus, it is possible, through the combination of PostgreSQL Views and PostGIS spatial functions, to compile these data sets to deliver selected information dynamically.

Other types of data could also be offered through Geoserver, although not belonging to the database itself, but that might enhance the prototype capabilities. This is the case of satellite imagery, which is not supported by PostgreSQL or PostGIS, but that could be incorporated in a transparent manner for client applications.

The use of standards WMS, WFS, and KML will allow the layer to communicate with a wide range of clients, varying from application levels like Google Earth to complex GIS systems such as ESRI ArcGIS, which allow multiple types of statistical and spatial analyses, not easily available in GeoWeb applications.

A Web application

A modular architecture based on open source tools and open standards was employed to build a browser safe interactive Web 2.0 application capable of display and manipulate geospatial data.

A homepage to support the development process was created at Embrapa Agriculture Informatics. In that site (www.projetos.cnptia.embrapa.br) it is possible to register the advances of each step concerned to the source code development, to keep the documents about the requirement specifications, tasks, reports, as well to control the source code versions and bugs to be fixed.

The local system architecture includes a database model, a layer of persistence (between the business objects and the database), a business-oriented layer, and the user interface. It was developed an entity-relationship model of the local system database. The Relational Database Management System (RDBMS) being used is PostgreSQL. That model supports all the identified attributes on each class package from the UML model. The persistence classes are being developed with the Hibernate tool. Tools compatible with Java Server Faces modules are being used for the user interface development.

Scientific and technical production (Paper – conference – prototype – software- …)

A) **Internal Technical Reports and Papers:**

1. UML Model of the OTAG local system;
2. Configuration management document for the local system development;
3. Papers prepared for the Scientific Conference at Cemagref (Clermont Ferrand)

B) **Prototype and software:**

1. Data generator is operational;
3. Architecture defined and tested for the data presentation layer.

For the detailed content of deliverables, a first part is included in the second scientific and technical report and from D3.4, sees the 3rd scientific and technical report sent with this activity report: period covered: 01/12/2008 to 30/11/2009.

- **WP5: Dissemination and improvement**

To remind the initial project expectations, see thereafter:

Objectives *This WP is devoted to dissemination of the project, its ongoing work and outputs (results). The dissemination work will start in month 1 of the project with the preparation of a* *Dissemination strategy, a dissemination plan (including meeting and workshop), publications and diffusion on the WEB site. Results transfer to the public and private sector:* *• Scientific community* *• Agro-Food private sector community* *• The European countries, Southern Cone Countries and Canada Communities*

Description of the Work *T5.1 Prepare the dissemination and communication strategy for the project with a WEB site.* *T5.2 Prepare the dissemination and communication action plan* *T5.3 Identify the stakeholders in Argentina and validate the prototype for recommendations* *T5.4 Undertake at least two dissemination activities during the project including publication of newsletter.*

Deliverables *D5.1 Dissemination vehicles include: Web site, Events participation (conferences, workshops, etc.), Scientific papers, Agri-industry journal articles, (M10 – M36).* *D5.2 Validation of prototype with the Argentinean beef sector actors (M34)* D5.3 Workshop on OTAG EU added value …- (M36)

Regarding D5.1: During 2008 and 2009, principal tools used include: (i) website information, including the OTAG Newsletter (also send out by email), (ii) workshop results diffusion, (iii) OTAG brochure diffusion (email and events), and technical reports and scientific article presentations and publishing, (iv) press releases. The following products have been diffused (available at: : http://www.otag-project.org/):

- Fanny Lange, 2008. Workpackage 2 Report – Traceability in beef cattle and crisis management in the bovine sector: State of the art.
- BATISTELLA, M.; OMETTO; A.; VIAU, A.; CHUZEL, G. Geotraceability in agricultural chains, an urgent demand in Brazilian agribussiness. In: GLOBAL CONFERENCE ON SUSTAINABLE PRODUCT DEVELOPMENT AND LIFE CYCLE ENGINEERING, 4., 2006, São Carlos. Proceedings... São Carlos: Suprema, 2006. 5p. 1 CD-ROM. (ISBN: 85-98156-25-6)
- OMETTO, A.; BATISTELLA, M.; GUELERE FILHO, A.; CHUZEL, G.; VIAU, A. Geotraceability and life cycle assessment in environmental life cycle management: towards sustainability. In: LOUREIRO, G.; CURRAN, R. (Eds.). Complex Systems Concurrent Engineering. London: Springer, 2007. p. 673-679.
- SEGUIMIENTO satelital para el ganado bovino en Brasil AgroDiario, Santa Fé, Argentina. January 10, 2008
- Um protótipo de geo-rastreabilidade para a cadeia de produção de carne bovina Boletim França Flash No. 59 – CenDoTec, Brasil. March 10, 2008
- 1st Newsletter - May 2008
- 2nd Newsletter - November 2008
- The newsletter n°3 has been published in August 2009.

A special thanks to PROCISUR which was particularly involved in the layout, the publication and the distribution of the dissemination vehicles for this last year. All the dissemination products are available on the intranet and on the internet. [OTAG website: http://www.otag-project.org]

- A brochure in 3 pages was designed for the final conference
- A booklet of 50 pages summarizing the full results has been published by Procisur.

Regarding D5.2 and 5.3, during 2008, several meetings were held with (a) Regional Mercosur project partner PROCISUR and (b) Key Argentine beef sector actors. PROCISUR team had identified both public and private sector stakeholders that are potentially interested in the “demonstration and validation activities of the project as envisioned in T5.4”, for 2009. Besides Argentina, this also included, Uruguay, Paraguay, Chile and Bolivia. An important Argentine beef sector actor is the Instituto de la Promocion de la Carne Vacuna Argentina – IPCVA www.ipcva.com.ar . The directors of the public/private entity representing the principal actors of the sector, had expressed their interest in collaborating with the project.

On September, 28th and 29th, was organized in Balcarce and Mar del Plata (Argentina) the final conference of the OTAG project with **a demonstration day of the OTAG prototype**. The main results of the project were presented in front of an assembly of researchers, professionals, representatives of the agricultural research centers and national sanitary services from different Southern Cone countries (Chile, Paraguay, Uruguay, Argentina, and Brazil). Were also present some of the members of the Steering Committee in order to make comments and recommendations.

The "workshop OTAG EU" foreseen for the end of the project will be coupled with the general conference on traceability expected by EU commission in September 2010. Cirad and Cemagref will participate.

For "Plan for using and dissemination the knowledge", see the separate file

Section 3 – Perspectives

Agro-food production as well as farm management differ substantially in their autonomy vis-à-vis the political and socio-economical environment. Political autonomy here refers to the degree that a farm and production management is the object of political and socio economical interests and dependent on them. In a highly politicised agro-food sector, the farming as well as the production system may frequently have to adapt to changing conditions of the market as well as the new traceability policies supported by new technology and production practices. Generally, an enabling socio-economical and public policies environment is considered necessary for a production region to function effectively, and it can generally be contended that the more favourable the conditions within regional and national politics, the greater the production area's autonomy, i.e. the lower the degree of its dependence on the socio-political constraints. The higher the autonomy, the better the possibility to develop and implement rules and longer-term activities adapted to the site-specific situation regarding the traceability and risk management issues for the different sectors of production.

Furthermore in many cases, the political arena in the agro-food production is closely connected to other issues such as indigenous politics, rural development programs or industrial exploitation of agricultural production and resources. Together they make up a complex of concurring and conflicting interests. Though agro-food product, quality and security concerns can claim to be of fundamental importance, in daily management they have to compete with several other socio-economical and political concerns related to the farmers situation, socio-economical issues etc...

Traditional production practices tend to neglect the political involved in agro-system and production new policies and regulation. Many authors have pointed that the tension stated principles, agency requirements, and donor interests in the agro-food business, and, thereby, reveals the need for a more thorough and consistent socio-political positioning as an essential component of sustainable agro-food production and agro-system conservation (high quality and safety products). To date, inadequate attention has been paid to the importance of institutions, local organizations, farmers association and analysis are required of the compatibility of production and agro-system conservation policies with the institutional setting within which they operate under traceability issues. Incorporating institutions increases the chance that implemented policies will have the intended consequences of promoting conservation and sustainable production practices. Research on common property institutions and sustainable governance of agricultural resources has identified the conditions under which groups of farmers will self-organize and sustainably govern the agro-food production upon which they depend. We need to provide a useful list: agricultural resource system characteristics, group characteristics, institutional arrangements, and external environment (market, technology, innovation etc.). This approach can be taken further: Institutions govern the relationships between the resource system, the user group, and contextual factors. They are therefore highly responsible, as a proximate cause, of the sustainability of these relationships.

Institutions are the 'rules of the game' and therefore in themselves an expression of the existing distribution of power. In our case, institutional failure can further be explained by a general conceptual mismatch between socio-economic and agro-production scales, which results in weakened feedback between decision makers and their production environment and thus produces inappropriate incentives and poor sets of agro-food traceability system and adapted technology related to implantation program, rules and regulations. Institutional factors such as stability and supportive legal and political frames are crucial for the successful adoption of traceability measures as well as an efficient risk management program and evolutes and adaptive system. Another frequent challenge is the unclear distribution of responsibilities among governmental administrative authorities with regard to decisions affecting the production sector as well as the farmers. Authorities governing each agro-food production sector, rural development, indigenous affairs, water and natural resources as well as territorial development often work without sufficient coordination, leading to prolonged decision procedures or, still worse, to counterproductive or competing programs. The lack of integration of agro-production traceability management system into regional development plans and land use policies in the surrounding production areas is in many cases a serious threat to effective agro-production risk management system implementation.

Regarded from the research perspective, there is still a clear lack of understanding of agro-production system functioning and of interactions between production sectors, agricultural practices, agro-market rules and socio-agro-economic systems. The actual state of public available monitoring traceability data shows that data coverage is fragmented, and standardized data gathering systems are not always in place. The narrow organization of research efforts along single-disciplinary lines or sectorial approaches constitutes a further institutional deficiency to the facilitation of needs-oriented interdisciplinary agro-production system research in the framework of traceability and socio-economical development of the producers and small farms.

The loss of market for the farmers has a significant impact on the viability of socio-economic production systems that depend on the various direct and indirect functions of traceability practices. The more individual interests and societal values are affected, the more traceability issues becomes a source of conflicts, ranging from disputes between local farmers and larger farms to serious conflicts that can arise between the producers and the authorities. Actions and decisions are linked on multiple levels. For example, unbridled local action can create global problems. Similarly, good production management at one scale may be dissipated by poor practices as well as not adapted economical support at another. Furthermore, because of harmful effects on agro-production traceability system services, which lead to a persistent decrease in the capacity of production system to deliver its services, an increase in poverty is unavoidable, especially in underdeveloped countries, and thus social conflicts bow to the inevitable (Millennium Ecosystem Assessment 2005).

In order to avoid unsustainable exploitation of agro-food production in or around agricultural production areas, the risk management has to determine and enforce rules and use restrictions up to zoning the area with ‘no-go’ or ‘no-take’ zones. This often implies conflicts. But the closer these restrictions are to the traditionally practiced forms of agro-resource production in the production area, the less the risk of conflict.

Conflicts arise from incompatibilities of interest and are part of every social system. Consequently the challenge for successful agro-production traceability management is peaceful conflict resolution under crisis or risk management issues. But a production sector is not a closed system where traceability responsible organization and farmer groups can progressively develop agreements on production practices and restrictions based on trust and past experience. Instead non-local actors with political and economic interests intervene generally in safety production issues to defend first their stakes. Thus agro-production sector function as political arenas for pursuing diverse interests. This gives rise to conflicts with multiple actors and multiple issues, which can have paralytic effects. Agro-producers conflicts can either focus on the differing perception, preferences, values, agro-economical situation and objectives of different actors, on the options and instruments they choose for action, or on a combination of both. Conflicts can be found in a variety of actor relationships and in the pattern of linkages between managing and co-managing institutions:

- Conflicts among actors (Who hold the power, governance?)
- Conflicts within the local farmer (access and use of resources, use and property rights, ethnic groups, etc.)
- Conflicts between the local farmer and agro-food industries, agro-food sectors management or state authorities (production practices against traceability regulation and related activities)
- Conflicts about the legal status and financial compensation.
  Etc.

In many cases, agro-production governance and traceability policies have failed to solve these conflicts and therefore to establish efficient agro-product quality and traceability system for an efficient risk management.

The scopes of socio-economical work related to agro-production traceability are link to the practices management for small farms characterized by manifold lines of tension. Farmers have to deal with divergent though not necessarily conflicting demands such as ones related to technology use and others relating to “traceability system development” and their socio-economical capacities to change or adapt their practices. The interests they face are often prima facie antipodal (individual vs. national program, technology push, profitability etc…), though -again -they is not automatically antagonistic. Nonetheless, traceability support organization always has to be prepared to address the uncertainty of the technology and the new production practices developments proposed to the farmers.

We divide challenges to agro-product traceability arising from aspects of protected production sector management into traceability management approach, agro-production management organization, financial aspects, product quality and safety objectives, stakeholder involvement, training program, enforcement, and consideration of local farmers livelihood needs.

What is the state of current agro-production management under traceability concepts, policies and practices? Witch framework solution to insure good practices and farmer socio-economical development? Many authors note a paradigm shift gaining ground, from a top-down, rigid, traceability-by-technological issues and new production practices regulation concept to a collaborative, flexible, stakeholder-oriented approach. However doubts remain as to the pervasiveness of new approach: though it may have become omnipresent in policy statements, on the ground, evidence of a comprehensive change is lacking.

Proponents of socio-economical adapted approaches are struggling with a common difficulty: they postulate certain causal relations and recommend a corresponding strategy without comprehensive empirical proof for their analysis. Protected agro-production sector supported by a traceability program constitute complex social-economical systems in which the variables may be known, but whose inter-linkages in a dynamic perspective have escaped our understanding so far. The influence of the wider political, economic, and social contexts associated to the different agro-production areas further complicates the analysis. Varying concepts of the relationship between the economical and the social sphere build the base for best management approaches.

Apart from the ethical concerns this implies, the situation is equally a scientific challenge: The links between the production traceability system’s complexity, its reconstruction through an analytic frameworks, and the socio-economical issues have not yet been explored.

Two opposing approaches are at the heart of the agro-production traceability debate: a restrictive position and an integrative people-included one. As stated above, the two approaches centre on different understandings of the link between the farmers and the new production practices. The restrictive approach puts production practices first: quality and safety product is conserved if it is effectively protected against external practices and economical pressure. It is either practice left untouched or new practices used and spoilt. The continuous high speed of practices degradation within the agricultural region protected by a traceability program is proof of the incompatibility of the program implementation and of new practices supported by non-adapted technologies with out any socio-economical policies and training program to support the farmers.

Following of OTAG

The PhD thesis (Thais Basso Amaral (Embrapa-Laval) is going on by some further stays in Cirad Montpellier in spring 2010 and a new PhD thesis is in preparation between Embrapa informatics and Cemagref - Clermont Ferrand, in the on-going of the MSc of Marcos Visoli.

Project’s public/private sector partner Procisur was interested to use the new OTAG technology as part of their updated and innovative products, especially in Southern Cone countries where they are aggressively attempting to gain greater market share. 3 Embrapa centres, especially Embrapa beef cattle of Campo Grande (Dr Pedro Paulo Pires), are expected for setting-up a project on this "technological transfer" operation, inviting private sector partners, to advance the prototype technologies to commercial uptake levels.

Procisur together with INTA-Argentine is designing appropriate documentation and detailed descriptions of systems and technologies (+ the various physical prototypes) in order to introduce these into various of the research laboratories that have expressed interest in experimenting with the system for other research purposes. This information will also be shared, through the assistance of Procisur, with the agricultural national research institutes in Chile, Uruguay, Paraguay and Bolivia.

Partnership with Canadian, French, Brazilian and Argentinean researchers was an additional beneficial effect of the OTAG International partnership.

National Food Safety Services (SENASA) from Argentina www.senasa.gov.ar and Paraguay www.senasa.gov.py have expressed their interests for the prototype technologies, since it would fit in a complementary way in their ongoing traceability activities and risk management systems regarding livestock disease outbreaks in their countries.

2010, February the 8th