

# **EtiNET® Web platform for traceability in the food chains: a regional scale implementation for quality insurance and food safety control in Italy**

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## **Abstract**

Increasing globalization of our food supply combined with recent outbreaks of foodborne disease has heightened concerns over food safety issues around the globe. In response to these growing concerns, both by government and consumers, many food chain stakeholders are looking at food traceability as a means to restore confidence in the food supply (food safety) and manage the products quality. Traceability, which allows for the tracking of food products through all steps of production, distribution, and sales, can provide information on the nature, origin, and quality of a food. This paper reports the Marche Region (Italy) project called SiTRA, aiming to provide food chain stakeholders with a Web platform managing traceability for the main regional food products. Consumers can identify the SiTRA traced products by means a Regional Brand (QM Quality guaranteed by Marche) embedded in the product label, reporting the traceability code to access the Web for traceability information of the product. SITRA platform is currently tracing 8 large food chains (fresh milk, bread, pasta, fresh fish, olive oil, wine, pigs and cattle) all over the Region. Organisational and technology aspects of the platform implementation are reported.

*Key words:* traceability, web application, food chains, food safety, quality insurance.

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## **1 Introduction**

“Traceability” is defined as the ability to trace the history, application, or location of that which is under consideration (ISO 9000 2000 clause 3.5.4). The introduction of traceability into the food supply sector is a relatively new concept that continues to gain momentum, particularly in the European community.

Within the food industry, traceability implies the ability to trace and follow feed, food, and food-producing animals through all stages of production, processing, and distribution. This requires a system capable of tracing products through the distribution chain, providing information on product ingredients, and understanding and communicating the effects of production practices and distribution on product quality and safety. Traceability by itself does not provide quality assurance, it is necessary to collect quality information along the chain concerning how it has been produced, processed and packed. This information are called credence attributes and enable producers to differentiate one product from otherwise similar products. Food producers differentiate products over a wide variety of quality attributes including taste, texture, nutritional content, cultivation techniques, and origin. Content attributes affect the physical properties of a product, although they can be difficult for consumers to perceive. Process attributes do not affect final product content but refer to characteristics of the production process.

The regional law n. 23 of 10th December 2003 provided Marche agricultural and food- system with a powerful instrument of valorisation: brand “QM - Quality guaranteed by Marche” (Fig. 1)



Fig. 1 QM brand: quality guaranteed by Marche

European Commission well approved the brand end of 2005. The Regional Committee, with two further deliberations, has adopted the regulations and the guidelines of the brand. QM brand is characterized by three fundamental elements: **Quality**, guaranteed by the respect of a quality insurance based on the best practise for each food chain and by the control of an independent body supervised by the Regional administration. **Trace**, guaranteed by using of a regional informative system, called SiTRA (see below), able to integrate the software systems already in use on the stakeholders' companies of the food chains. **Information**, that SiTRA provides the consumers with, concerning the origin of the food and the processing it faced. Short information are provided on the food labels, extended ones are available accessing the WEB with the traceability code.

Supporting QM trademark traceability, a web platform called SiTRA has been implemented by AltaVia srl during 2005 and 2006. The company won a trial between 21 software companies. AltaVia srl developed SiTRA starting on its product called EtiNET® ([www.etinet.biz](http://www.etinet.biz)).

## 2 SiTRA: IT platform requisites

**Core Platform Technologies:** WEB based, .NET Framework 1.1, WSE2, Windows2003 Server, SQLServer2000, SOAP, XML/ebXML

**Food Chain Modelling:** SiTRA must be able to manage the regional food sector as a whole, it means tens of different food chains. The system has an external semantic which can be modelled by means a visual interface. Chain model is stored in the regional repository to be modified, updated or integrated.

**System Integration:** SiTRA must acquire traceability data from stakeholders existing IT systems. A set of Web Services have been built that are able to produce an XML data schema based on the chain model, this XSD can be used to send information to the central platform and receive a detailed validation check in.

**Devices integration:** bar code readers, label printers, wholesale & retail scales and other traceability devices must communicate with SiTRA platform

**Multi standard:** the ongoing data model traceability standards and the lack of available standard for same niche food chains require the platform to be flexible for fitting the changing standard environment. EAN.UCC has developed an open integrated system to standardize and automate information systems across a supply chain that includes GTINs, along with an industry standard set of 62 product attributes (EAN.UCC, 2003). For some other products quality guidelines are available locally.

## 3 Core Platform Architecture

On the following schema (Fig. 2) is reported the architecture of the SiTRA platform.

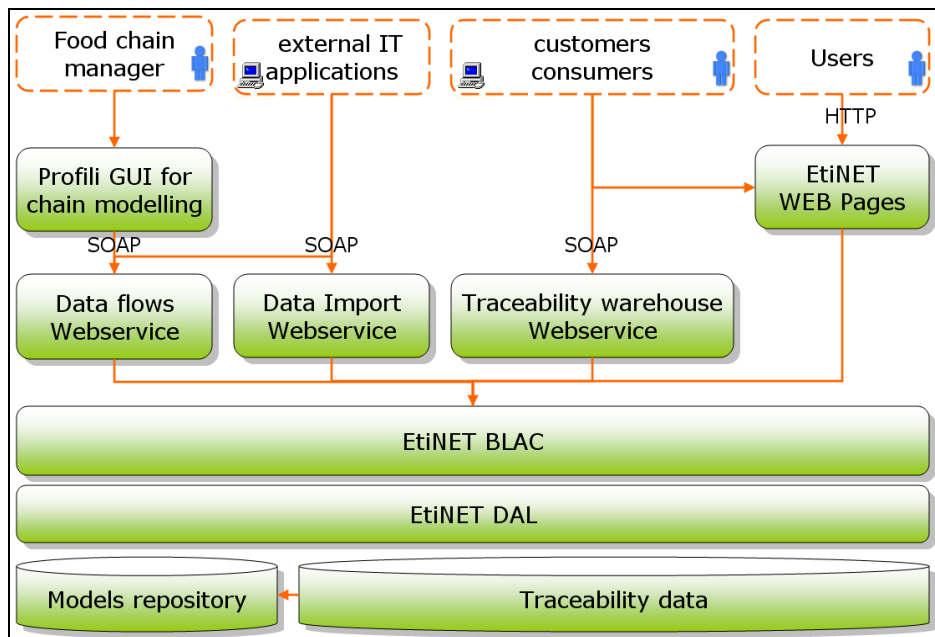


Fig. 2 SiTRA platform architecture

EtiNET WEB Pages are dynamic ASPX pages which allows user to insert tracking information according with a specific food chain data flow model. Profili GUI is a VB.NET client for the visual modelling of a traceability data flow schema (see paragraph 4). Data Flow Web Service enables modeller GUI to store and retrieve information concerning the food chain data flow model. It also provides external application with the formal definitions of data elements in an XML document (DTD) according the active data flow schema: traceability resource definitions (operations and materials involved), measurement units, actual traceability data, security roles to have access to certain types of data.

The Data Import Web Service enables remote clients to store actual traceability information into the DBRM by means XML files compliant with the active chain DTD. It follows a synchronous request/response scheme. A request constitutes a transactional unit, so that all the data in one request is saved using the same transaction. Duplicate data, either internally in the request, or duplicates already in the system, is rejected. All the importing errors are reported back to the client.

Traceability warehouse Web Service enables remote clients to retrieve data from the DBRM. It uses different methods of communication like SOAP or HTTP.

EtiNET BLAC represents the business layer of the platform and the EtiNET DAL is the data access layer. Model repository is the repository of data flow schemas describing the food chains managed by the platform. Each chain modeller can retrieve the food chain schemas for coping, extending and joining. Traceability data is the data base of the traceability information concerning all the food chain managed by the platform allowing cross reporting and data mining.

#### 4 Modelling the traceability information for food chains

The client software to design traceability data flows is called PROFILI (Fig. 3), it is completely generic and can be used to model traceability within any type of chain.

During the configuration process of a new chain, the semantic information are stored into the chains' repository by means a graphical user interface. Chain operations (in broad sense), materials involved, data flows and the concerning attributes are managed by mean of a user friendly interface connecting through SOAP protocol with the central repository. The food chain data models repository is a tables cluster in the same DBRM where also the traceability actual date are stored. The chains stored in the repository can be extended, used as a template for a new chain and joined between them. An entity cannot be erased if any related traceability data is already stored. Chain data model can be saved locally on the modeller PC hard disk as XML file.

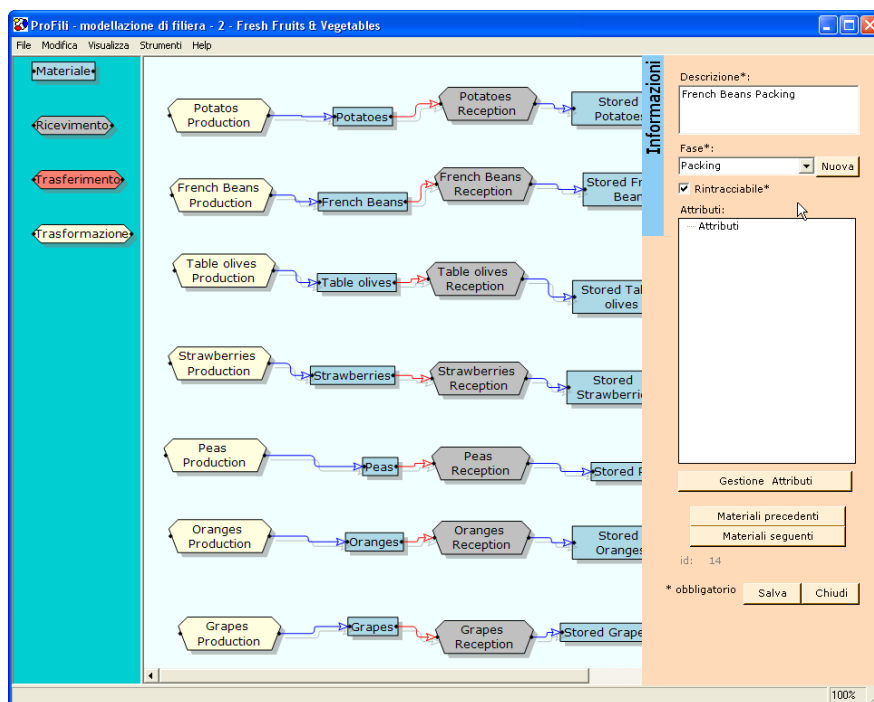


Fig. 3 User interface of the food chain designer tool (Profili)

Designing the food chain is the role of the modeller who usually is an agronomist with a deep knowledge of the food chain to be designed. The software supports having many food chains schemas stored, but a set of traceability data can only be linked to one particular chain model. Exchanges of lots between different chains are allowed if the modeller links the two (or more) chains during the modelling process. When a new chain data model is published in the central repository the traceability schema is immediately active and data can be entered by the stakeholders through the Web interface or the Web Services.

The implementation of a new regional food chain in SiTRA platform follows this path: (1) focus groups composed of leader chain's stakeholders define the blueprint of the target food chain. (2) the modeller designs the food chain according with the blueprint. (3) a prototype of the chain is tested on line by the focus groups' stakeholders. (4) major or minor changes are made on the chain schema according with the test feedbacks. (5) the chain is published on the SiTRA main server and made available to the operators.

## 5 System integration

Implementing a traceability platform on large scale requires the system to interface with all the enterprise software used by the stakeholders. Regional administration provides operators involved in the regional traceability project for QM trademark with funding to make enterprise software compliant with SiTRA platform. Compliant means that local IT systems are able to load tracking data on SiTRA and retrieve stored traceability information on their own lots. Is up to Marche region to enlist on a public web page the shortlist of traceability applications compliant with SiTRA.

SiTRA platform provides with several methods to store and retrieve tracking data. These methods can be instanced through a set of Web Services running on a SiTRA server. The software companies that want to make their products compliant with SiTRA can interface this Web Service set from their IT application. They can access, free of charge, the whole documentation concerning the public methods and the way of using it through the regional SiTRA server.

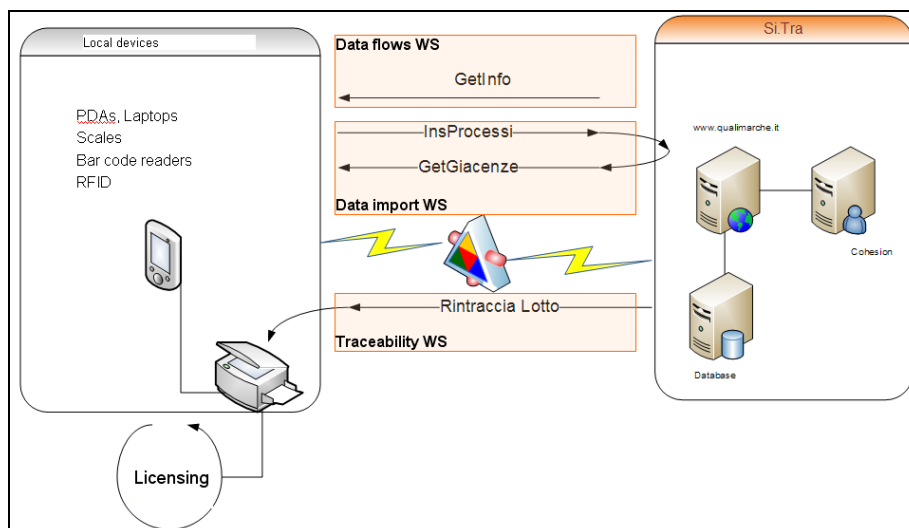


Fig. 4 Schema of the external interface of SiTRA

Security is ensured by WSE (Web Services Enhancements); it uses the mechanisms defined in the WS-Security specification to place security credentials in the SOAP message itself. This is done by having a client obtain security credentials from a source that is trusted by both the sender and receiver.

## 6 On field implementation: organisational aspects

The day-by-day management of the SiTRA platform is in charge of ASSAM, regional agency for agricultural research & development. ASSAM is a public body owned by regional administration but with an independent budget. Within ASSAM has been set up a task force (4-5 people) in charge of: (1) SiTRA servers management (2) extension of the platform with new interfaces/functionalities depending on the food chain needs (3) design the data flow for the food chains (4) promote the focus groups from the food chains (5) define the food chain traceability guidelines and documentation (6) front end help desk (7) food operators training (8) investigate traceability IT applications asking for SiTRA compliance

The stakeholders of a food chain can access SiTRA service free of charge, only the costs of integration of their IT local application is up to them. Founding has been made available in the last 2 years to cover up to 50% of such costs.

The lots of food traced by SiTRA can use in the label the Marche Quality insurance trade mark (see Fig. 1). An independent certification authority is in charge of check the whole system and the involved stakeholders to guarantee the real implementation of trademark guidelines in the product's processes.

The choice of implement new food chains is driven by operator (market requests) or by regional policy bodies (public instances). SiTRA task force can implement not more than 3-4 new food chain per year. The requests for new chains overcome the task force resources and some important regional food chains are still waiting. The following table enlist the food chains already implemented in SiTRA.

Food Chain	Members (n. stakeholders)	Starting year
Fresh milk	60	2004
Fresh fish	327	2004
Bread & Pasta	236	2005
Wine	4	2006
Olive oil	5	2006
Meat	testing	2007

Fig. 5 Food chains implemented in SiTRA

The organisational flow is highlighted in figure (Fig. 6).

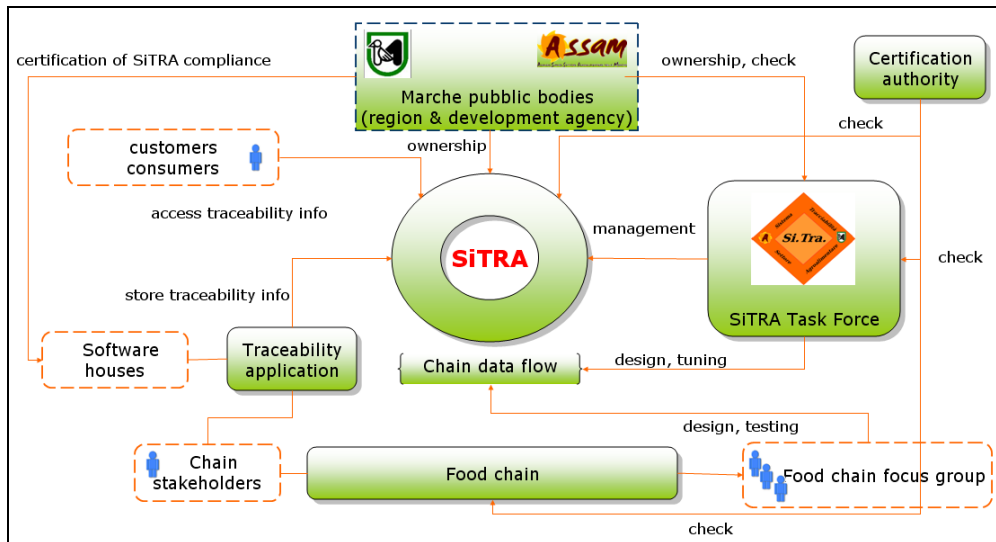


Fig. 6 SiTRA implementation schema

## 7 Conclusions

Considering the growing importance of traceability as a tool for assuring the healthfulness of plant and animal food products by tracking their history, utilisation and sources, for the protection of consumers and also considering the need for traceability to be defined within the wider context of the certification of farms, SiTRA project can be considered a success history of public action for the regional agri-food sector. The decline in consumer confidence has been exacerbated by the introduction of genetically modified organisms, plants and animals into the human food chain. The purpose of SiTRA platform is to permit the full backward and forward tracking of a product and its life history in the supply chain, from farm to fork. It is therefore a preventative quality and safety management tool. For the regional small-scale grower and postharvest operators, traceability may be part of an overall cost-effective quality management system that can also assist in continuous improvement and minimisation of the impact of safety hazards through rapid determination and isolation of sources of hazards. Besides, the quality trade provides the companies with a new competitive factor.

The implementation of SiTRA is currently facing the main challenge that is the lack of coordination among the many small-scale stakeholders involved in the food chains who are not used to work together as a team.

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