System Integration and Certification. The Market Demand for Clarity and Transparency – Part 2

by

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1. Introduction

The concept of traceability takes on a completely different significance when it is extended beyond the farm to embrace the agroindustrial sector as a whole.
In this case, traceability means the ability to retrace all the stages of the production and distribution system, and must therefore be viewed as traceability over the entire agri-food chain, from farm field to the consumer's table.
It follows that agri-food chain traceability will be relatively simple when all the processing is handled by a single organisation, but becomes extremely complex for multiple-ingredient products which call upon a number of different systems for raw material production, processing and marketing (**Figure 1** and **Figure 2**).
It is necessary, in this case, to identify and characterise all the material flows (raw materials, additives, semi-finished products, packaging materials etc.) that converge into a given product, as well as all the organisations involved at each stage, in order to ensure that the product's history can effectively be retraced to ascertain the causes and responsibilities for any problems or defects.
Agri-food chain traceability is therefore a concept which can be defined as:
"the identification of the organisations and material flows involved in the formation of a product unit that is individually and physically identifiable".
From this definition, it follows that traceability is based on two fundamental elements. Firstly, the fact that traceability is in effect an allocation of *responsibility*, making it substantially different from other product and process assurance systems such as ISO 9000 for quality and HACCP for safety, which are both designed to control technical aspects.
All the actors involved in the preparation of the product must assume responsibility for the materials used, and for the procedures and operating conditions within their competence, so that in case of harmful or defective products the causes can be identified and the appropriate corrective and control actions implemented.
The second fundamental element of traceability is the *lot*, that is to say the unit of product that can be physically and individually identified, and which provides the true basis of an effective system for managing emergencies and attributing responsibilities. In fact, the lot makes it possible to identify all the units which have undergone a given production process, so that they can be isolated in the event of quality or food safety problems.

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2. Definition of a traceability system

The complex composition of the agri-food chain makes it very difficult to define a single traceability system that can be applied to the broad diversity of food products.
It is therefore necessary – as has already been done for quality certifications with ISO 9000 - to define general standards which provide guidelines for the implementation, management and surveillance of agroindustrial traceability.
Such standards should aim to assure the traceability of each specific product and the individual actions taken to produce it, as opposed to generic supply chain traceability, as well as to identify the organisations involved in its formation.
A framework of this type requires that some designated "leader" handle the coordination the supply chain, a role that could presumably--though not necessarily--be filled by the organisation which markets the finished product. The leader organisation would be responsible for tracing the agri-food chain leading to the formation of the product, and for defining operational procedures to assure that the causes and responsibilities of any food safety hazards can be identified.
A traceability standard could be developed along the following lines:

- *identification* and *designation*, as the agents responsible for traceability, of the organisations which handle the processing operations and transfers of primary raw materials or other components significant for the purposes of traceability, and of those which supply secondary materials (process agents, additives, packaging, etc.);
- *designation* of a coordinator responsible for defining the operating methods and traceability procedures, and for collecting the relevant documentation and ascertaining compliance;
- *documentation* of the material flows within the agri-food chain, recording each passage in qualitative and quantitative terms;
- *management* of lots through every stage of the process, ensuring that they are identifiable and that their traceability is documented at all times;
- a *code of agri-food chain* on each of the documents which accompany the loose or packaged materials entering the production process;
- the *marking* of every package that reaches the end consumer with a logo identifying the agri-food chain, and with a lot code;
- the *possibility of traversing* the supply chain in both directions: in order to both "trace" (i.e. work back from the finished product to its origins) the nature and history of all the components, as well as "track" (i.e. reconstruct its forward progress) an unsafe raw material in order to identify the finished product lots which may have been contaminated by it.

3. Compulsory or voluntary traceability?

Placing the procedures for agri-food chain traceability within an appropriate regulatory framework is a question of primary importance.
Some organisations—most notably the European Union—appear to favour a statutory imposition of traceability. In fact, in its White Paper on Food Safety, the EU in states that "... the competent authorities monitor and enforce this responsibility through the operation of national surveillance and control systems ...." [5].
An alternative route, however, would be to leave agri-food chain traceability to the initiative of individual organisations who voluntarily undertake to comply with the rules and procedures set out in the standard.

In the compulsory case, traceability is treated as essential for the assurance of product safety, and hence encoded in a legally binding framework of rules, in much the same way as HACCP hygiene monitoring.
This solution has the advantage of a generalised application of traceability, but also presents a number of shortcomings.
The HACCP experience has highlighted the difficulty of achieving simultaneous compliance by such a large number of production systems and firms, as well as of intervening in business management decisions – by definition tied to the discretion of the entrepreneur – with unified systems for hygiene surveillance.
What's more, there is the risk that a compulsory system will, on the one hand, prove cumbersome and difficult to manage for certain types of organisations, and on the other hand will suffer from the absence of an appropriate and efficient public enforcement system.
Therefore, compulsory traceability could potentially prove difficult to implement, giving rise to an inefficient system of surveillance, thereby opening the way to purely formal applications and false documentation [4].
In contrast, a voluntary system – based on a univocal definition of traceability set out in an international standard – implies a free and conscious commitment on the part of the organisation's management, and therefore leaves less scope for dodges or accusations of excess complexity.
In addition, this type of approach would make traceability a selling point to the consumer, making it an element of added value on the marketplace, thereby enhancing the competitiveness of the product.
Voluntary traceability would therefore have the practical effect of making its fair application advantageous to the producers themselves, as well as to the surveillance bodies.

4. Certification of traceability

It is clear that agri-food chain traceability must be subjected to surveillance and certifications, performed by independent bodies that are credible and representative. In fact, a false declaration of traceability does not just constitute a deception vis a vis the consumer, but is also an act of unfair competition between firms.
In the case of voluntary adoption of agri-food chain traceability, the certification could consist of:

- an *international standard* which sets out general implementation guidelines;
- a number of *certification bodies* accredited by the national standards authorities;
- a system for *documenting material flows* that is appropriate for the different product supply chains.

The final watchdog role, however, would have to be played by the competent public authority, presumably the Ministry of Agriculture or the equivalent regional bodies, which would handle the general supervision, taking part in the accreditation of the certification and control agencies, as is already done in Italy for DOC (controlled origin) marks and organic farming products.

5. Conclusions

Traceability is a tool of fundamental importance for answering the market's growing demand for food products whose safety is assured by a transparent system that is able to attribute responsibilities to farmers and producers.

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The best solution for ensuring correct application would be to define a food traceability standard which can be voluntarily adopted by organisations, enforced and supervised through a synergetic collaboration between private organisations and public product certification bodies.
Agricultural mechanisation (or, better, the whole agricultural engineering sector) plays a key role in building a traceability system being appointed to monitor the first steep of the food chain from the field to the process phase.
As it has been underlined by preceding speakers (namely Auernhammer [1], Nääs [2] and Reid [3]) recent development in electronics and sensors technology made now available data collection systems that can provide the basis for the development of agricultural traceability. Current localization systems based on differential GPS can offer accuracy in the order of 1-2 m, while "variable rate" distribution systems and "yield monitoring" systems can easily record what and how much we distribute and we harvest.
So the main steep for the development of a reliable traceability in field cultivation and animal breeding is to enforce and expand data collection systems in order to create a data archiving system able to permanently house and flow information following the different food components along its routing from field to table. At the same the importance of appropriate certification bodies has to be underlined.

6. References

[1] **Auernhammer H.**, 2002. *The role of mechatronics in products traceability.*. Club of Bologna, 13th Members Meeting (Part 1), Chicago.

[2] **De Alencar Nääs I.,** 2002. *Applications of mechatronics in animal productions.* Club of Bologna, 13th Members Meeting (Part 1), Chicago.

[3] **Reid J. F.**, 2002. *Sensors and data collection systems on agricultural equipment.* Club of Bologna, 13th Members Meeting (Part 1), Bologna.

[4] **Peri C.**, 2000. . *Tracciabilità di filiera. Tra obbligo di legge ed opportunità competitiva per le produzioni agroalimentari.* Atti della Accademia dei Georgofili, XLVII.

[5] 2001. *White Paper on Food Safety.* Commission of the European Communities, Brussels.

Figure 1 - Traceability chain is simple in the case of single product

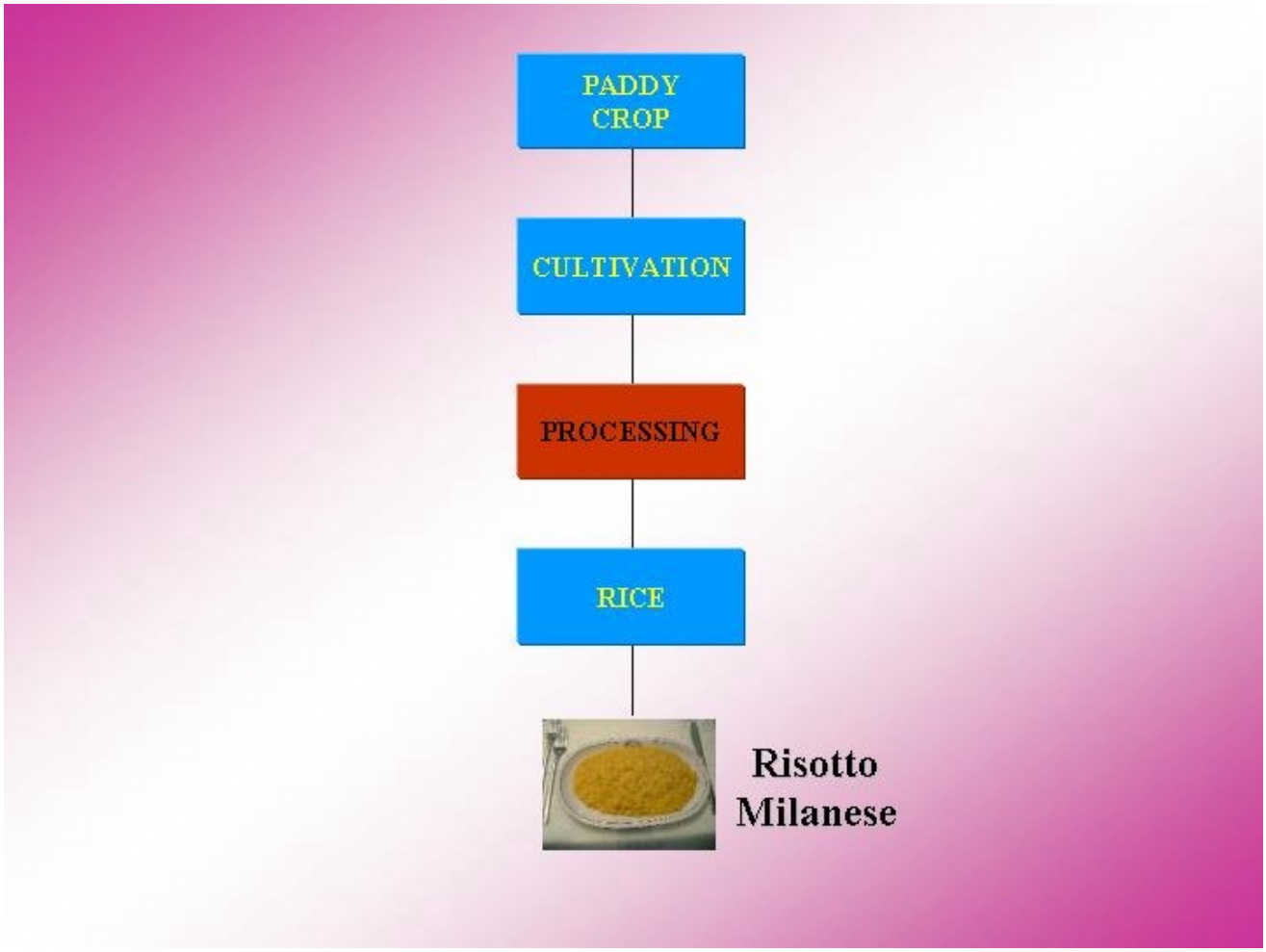

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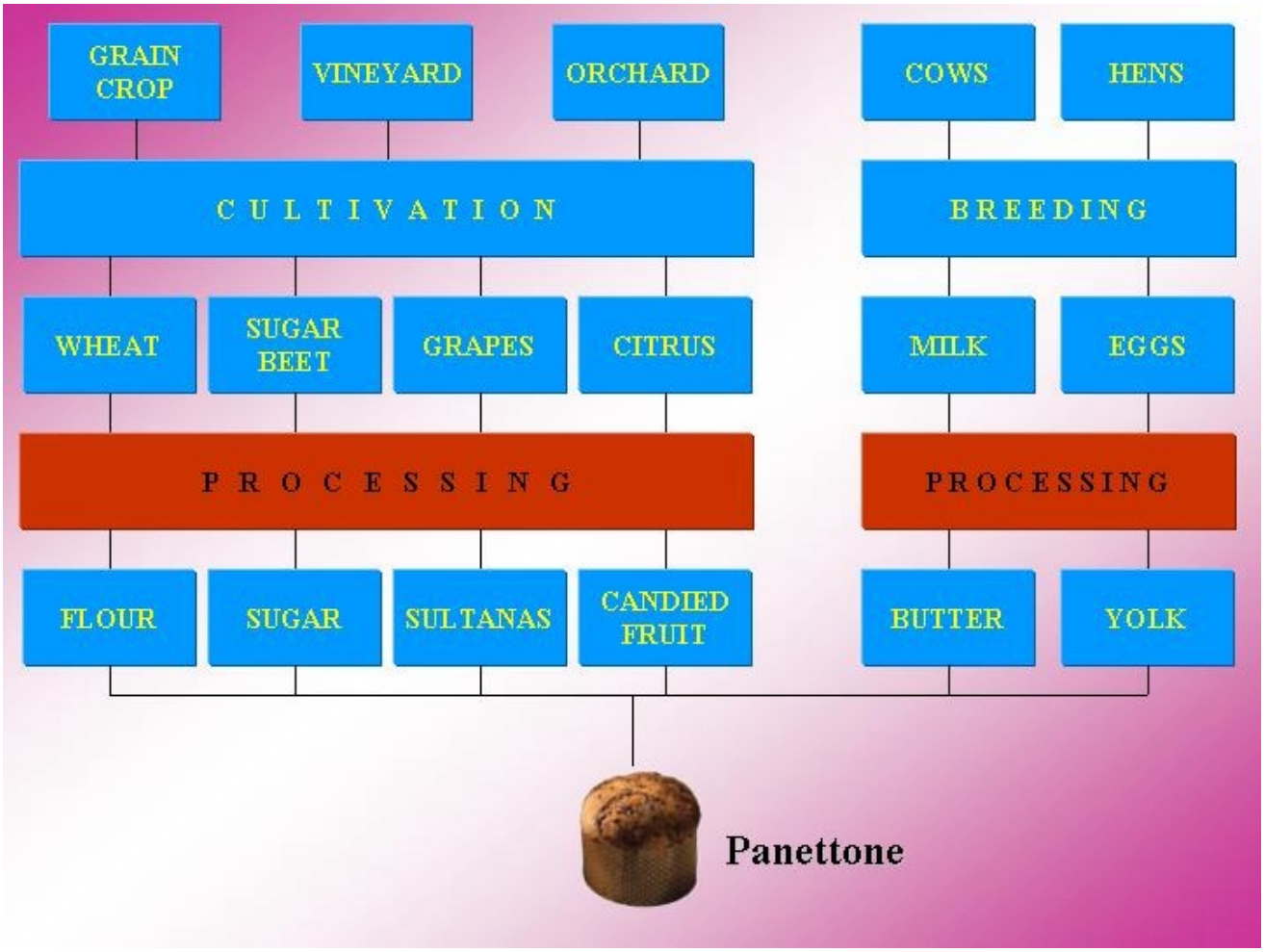
Figure 2 - Traceability is very complex in the case of a product with multiple-ingredients



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