Traceability requirements for information systems in the agro-food sector

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Abstract. Food safety and quality are keys to companies' business survival and great effort and resources are devoted to them. The food production chain, from the farms and feed mills to the finished products leaving the processing plants, is subject to independent examination and auditing either under the sector's own assurance schemes under official regulatory inspection and testing programmes with published results. For farmers and the agro-food industry, this means new market opportunities – and continual change. Food safety is an on-going challenge, demanding the best control systems and day-to-day vigilance on farms, in processing plants and throughout the distribution system. In order to enable consumers to make the right choice when buying their food and in order to build up markets for quality products, labelling has to provide all relevant information about the production process. Besides complete information about its ingredients, food labels should bear information about its place of origin and the way in which it was produced.

Keywords. Food safety, information systems, identification, traceability

Introduction

In the beginning of 21st century the matter of food-safety plays an accentuated role in the food industry. Important issues in this topic are the risk of bioterrorism, impurities in the food-chain and the ascendant customer needs. The solutions of these problems are the introduction of modern information and quality systems, traceability and identification of products. I review in this paper the possibilities of these systems, the potential advantages and the technologies of identification. I discuss the most important criterions of systems which probably can solve the today's quality problems of food-industry.

Technologies of identification

Traceability can not be solved without high level identification. The identification of food items is based essentially upon two categories of identifier:

Primary identification (based on the use of biological markers and feature extraction based upon anatomical, physiological, biochemical or molecular, including DNA, methods of identification).

Secondary or data carrier-based identification techniques in which a number or alphanumeric string is used for identification purposes and may be accompanied by other data or information for traceability or process support purposes.

A secondary identifier may also be linked to a primary identifier, particularly where the primary identifier is held as a data template in a data carrier or database. Meta-data may be used to distinguish data types and assist in automatic identification and handling of source data concerning the item or items being processed or handled.

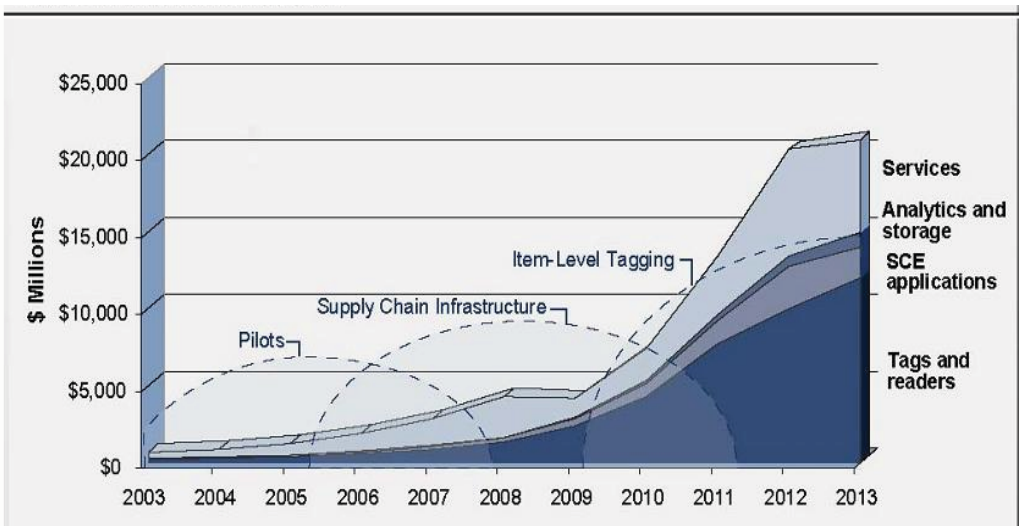

Figure 1. RFID market evolution (Source: AMR Research)

A wide range of reader-supported data carriers are now available for use in structuring and developing process support systems and traceability. The predominant carriers include:

- Linear bar code symbols

Linear bar codes have been used extensively in retail and supply chain logistics for many years, as an effective means of machine-readable identification and data transfer. A range of symbologies is available to satisfy a variety of data encoding needs, a symbology being the rules determining the way the bar-space symbols are structured to encode character sets. A number or alphanumeric character string encoded within a bar code symbol is used as a means of identifying an item and / or associated information held in a database or other storage facility. Linear bar codes may also carry meta-data identifiers and a limited amount of standalone information, such as expiry date or weight.

- Multi-row bar code symbols, matrix code symbols, composite symbols

A range of two-dimensional, multi-row bar and matrix data carriers is now available, featuring attributes that are complimentary to linear bar codes. Of particular significance in this respect is the ability to carry substantially more data than linear bar code symbols or the same data in smaller space. This capability is engendered in what is generally referred to as the 'portable data file' concept, wherein data is carried as stand-alone machine-readable files. Carrying data in this way constitutes a radical vehicle for process improvement, where opportunities are recognised. They also provide a platform for alternative solutions to data carrier problems that would be difficult or impracticable to satisfy using linear bar codes. Two-dimensional data carriers share some of the features of linear bar codes including read-only capability, line-of-sight reading and low cost data carrier format.

- Radiofrequency identification data carriers

RFID is a transponder technology which is set to play an increasingly important role in the field of logistics alongside existing automatic identification systems such as barcodes. RFID transponders are already in successful use for identifying animals and containers, as part of access control systems, in vehicle immobilizers and in automated production. But the retail and service industries as well as procurement, production and distribution logistics see extended fields of application being opened up by RFID technology, bringing with it greater efficiency in monitoring and controlling supply chains, whether it be in the reduction of stock levels, the optimization of just-in-time processes, the regulation of traffic control systems in ports and airports, the tracking of shipments or in the monitoring of mechanical or climatic influences on goods during shipment. It is assumed that the greatest potential will be in those sectors that have the highest demands on quality and process reliability, such as the

pharmaceutical, chemical and automotive industries. Unlike with barcodes, RFID transfers data between for instance a package (equipped with a transponder) and a data capture unit (reader) with no need for contact or a direct line of sight. It is also possible to capture the data from several different data carriers simultaneously and to read the information through a range of different materials. Furthermore, the data can be tracked in realtime in defined areas. RFID is based on electromagnetic waves with frequency ranges from long wave through to microwave. The technology involves a data capture unit or reader reading the data from a transponder (data carrier with an integrated antenna - also known as a "tag") and/or writing new or additional data to the tag. (http://www.tis-gdv.de/tis_e/verpack/rfid/rfid.htm)

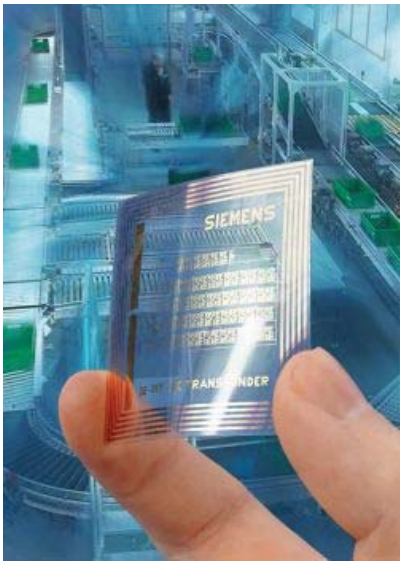

Figure 2. RFID tag

Data Carrier and Capture Capabilities

In recognizing the need for flexibility in defining traceability systems to satisfy different supply chain needs it is necessary to identify a range of technologies and associated products to meet these needs. The technologies may be conveniently grouped as follows:

- Item-attendant data carrier technologies – including linear bar codes, two dimensional (multi-row bar code and matrix codes) and composite codes, contact and non-contact magnetic data carriers, contact memory and radio frequency identification (RFID) data carriers.
- Item-attendant feature identification technologies – including static and dynamic feature-based systems, identification based upon physical and chemical properties, including DNA profiling.
- Item-attendant location and locating technologies –including RFID and GPS locating technologies.
- Item-attendant communication technologies – including wireless local area network (WLAN) technologies.
- Item-attendant sensory – exploiting at the item level developments in sensory and telemetry technologies.
- Item-attendant security technologies – embracing a range of technologies for fraud prevention and security at packaging level.
- Data storage and communications technologies – including large volume relational data base technologies and both local and wide area communication technologies.

Modern traceability and communication between information systems

One of the answers of the modern traceability and communication between ERP systems is the realization of EDI and/or XML techniques. Electronic Data Interchange, the transfer of data between different companies using networks, such as VANs or the Internet. As more and more companies are getting connected to the Internet, EDI and XML are becoming increasingly important as an easy mechanism for companies to buy, sell, and trade in information.

With this data interchange techniques, paper transactions can be replaced by electronic transmissions, thus time is saved, and the potential for error is minimized. Data can be exchanged at any time. Related business expenses, such as postage, printing, phone calls, and handling, can also be significantly reduced. EDI can aid in the support of manufacturing efforts, such as Just-in-Time and Third Party Warehousing, and financial efforts, such as Electronic Payments.

These translation and communication software is available for most computers, whether PCs, minicomputers or mainframes. Basically all EDI software packages do the same thing. Translation software translates business documents into a standardized format that complies with ANSI X12 or EDIFACT, and communication software sends and receives documents or standardized data groups.

Traceability in inforamtion systems

Only an integrated information system can meet efficiently with these objectives. The integration into business processes guarantees:

- Online capture of data right at the source without the need for additional resources
- Online processing of data, eliminating the need for isolated, stand-alone solutions
- Seamless proof of origin throughout and beyond the industry-specific ERP software

An ERP system in the food industry is specialized in transparent proof of origin and safeguarded traceability for all segments of the food industry and in accordance with all prevailing international standards (including Reg. (EC) No 178/2002, 1830/2003, EUREP-GAP, IFS, HACCP, ISO9000, BRC, GLP, GMP, GHP). On the basis of the cross-industry standard EANCOM we have developed a solution that allows for flexible interchange of origin data between companies and organizations. With the help of this data interchange mechanism, user companies can guarantee seamless farm-to-fork proof of origin for each and every batch that has entered the production process.

Users profit from the following essential benefits:

- Maximized growth potential through completely integrated information processing
- Variable weight items and equalized units
- Flexible planning of materials and capacity resources
- Reduction of inventory costs through paperless order processing, picking, and delivery
- Transparent quality management (paperless HACCP) and seamless traceability
- Solid integration of numerous locations via Internet and Intranet

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