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APPLICATION OF RFId TECHNOLOGY TO THE AGRO-INDUSTRIAL SECTOR: ANALYSIS OF SOME CASE STUDIES

ERICA VARESE (*), STEFANIA BUFFAGNI (*), FRANCO PERCIVALE (*)

Abstract

The importance of the food stuff tracking is always most relevant from the alimentary industries and from the agrarian politics of the European Comunity, according to the dispositions of the Reg. CE 178/2002. Particular interest has from this point of view the application of the Radio Frequency Identification (RFId) that employs a radio frequency to identify, recognize and to locate an object.

In the food sector, use arises from the need to find a system to improve the management of tracking along the production chain and that protect the consumer against untrue claims on the product.

The present work has been conducted particularly in the agro-industrial sector on the subject of food safety and of the tracking methods used by the economic stakeholders of the sector.

104 farming cooperatives belonging to the Fedagri-confcooperative Piemonte were examined. The sectors investigated were milk-cheese (18 cooperatives), fruit and vegetables (39 cooperatives), breeding (18 cooperatives) and vine growing (29 cooperatives).

The criticism that has emerged from this study are the elevated costs, the difficulties to implement such technology in all the phases of the commercial iter with the purpose to allow the information flow to the final consumer.

The case presented in the fruit and vegetable sector revealed how RFId technology is still unable to meet the real requirements of the firm, offering interesting points of reflection to improve its structural design.

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Riassunto

L'importanza della tracciabilità dei prodotti agro-alimentari è sempre più sentita dalle industrie agro-alimentari e dalle politiche agrarie della CE, in linea con le disposizioni del Reg. CE 178/2002. Particolare interesse ha suscitato da questo punto di vista l'applicazione della Radio Frequency Identification (RFId) che impiega una radiofrequenza per identificare, rilevare e localizzare un oggetto. Nel settore agro-alimentare tale impiego nasce dalla necessità di trovare un sistema che migliori la gestione della tracciabilità lungo la filiera produttiva e che tuteli i consumatori contro attestazioni non veritiere sul prodotto.

Il presente lavoro è stato condotto nel settore agroindustriale in particolare sulla sicurezza alimentare e sui metodi usati dagli operatori economici del settore per tracciare i prodotti.

Sono state esaminate 104 cooperative agricole appartenenti alla Fedagri-Confcooperativa del Piemonte. I settori analizzati furono il lattiero-caseario (18 cooperative), frutta e vegetali (39 cooperative), carneo (18 cooperative) e vitivinicolo (29 cooperative).

Le criticità che sono emerse da questo studio sono il costo ancora elevato, le difficoltà di implementare tale tecnologia in tutte le fasi dell'iter commerciale al fine di poter consentire il flusso di informazioni fino al consumatore finale. Il caso presentato nel settore ortofrutticolo ha evidenziato che la tecnologia RFId non è ancora in grado di soddisfare le reali esigenze dell'azienda, offrendo interessanti punti di riflessione per migliorarne la progettazione strutturale.

Keywords: Radio Frequency Identification, tracking methods, agro-industrial sector.

Introduction

Identification systems of goods, animals and persons are continuously evolving, also as a result of a technological research that is introducing and gradually improving solutions capable of bringing undoubted advantages on the operating plane both to companies and to the subjects that use them. Recent information technologies and the parallel development of new organisation systems allow firms to manage data associated with the production process more efficiently and effectively and to develop correct communication both inside and outside the company.

With reference to issues of data security, tracking and automatic identification of objects, over recent years particular interest is being arou-

sed by the so-called "RFId" (*Radio Frequency Identification*), the acronym used to indicate all those applications that use a radio frequency to identify-recognise-locate un object. Simply put, these systems are based on the remote reading of information contained in a particular label (*the RFId tag*), that is activated by a special *reader*; this way, through electromagnetic pulses, it becomes possible to codify the data contained in the tag that accompanies the product during the entire production process (1).

The growing interest and expectations associated with this type of applications, aptly defined as the "technology of the future" (2), together with their rapidly growing popularity at national and international level, have led institutions to take a clear and decided position on the subject and on many occasions the advantages that this technology can bring to public and private subjects in many different fields, also including the agro-industrial one, have been pointed out.

In fact, in the past few years the radio frequency identification system has been arousing interest among the operators of this sector, ever seeking solutions that make it possible to achieve food quality and safety objectives, also as a result of the past food emergency situations that have involved European states.

The possibility of using RFId as a tool for managing the flow of information that characterises the production of a food would facilitate the control of the entire tracking process, as required by Reg. (CE) 178/2002 (3). The end purpose is to warrant the utmost safety for the consumer concerning the truthfulness and the origin of the product, since the information contained in the chip is monitored and updated at each step of the production chain. RFId is an innovative technology and, as such, is still in the "initial" experimentation and testing stage. Over the past few years, both in Europe and Italy pilot projects have been conducted to verify the actual applicability of this technology in the main food sectors.

In the livestock sector for example, RFId is considered a possibility not to be underestimated in improving the main operating activities in breeding and slaughtering. According to the census of the Observatory of the Milan Polytechnic in the 2007 annual report (4-5), lately many pilot projects are developing, aimed at both increasing the effectiveness of the present livestock identification and recording systems and ensuring effective control in the handling of them.

Currently three types of electronic devices exist in commerce:

- Injectable tag: small-sized, made of non porous biocompatible material, it is injected directly into the animal's body, usually at the

base of the ear or in the axillary area;

- Electronic auricular brand: the tag is inserted in the structure of the auricular brand, after being suitably coated with plastic material;
- Cud: the tag is contained in a ceramic capsule (or, alternatively, thermoplastic material or in a steel sheath), which is swallowed by ruminants and thus remains in the rumen.

Starting from the last decade of the previous century until now, the European Commission has funded many study projects on the applicability of these systems in the livestock sector. One of the latest ones in time sequence is the IDEA project (*Identification Electronique des Animaux*), which began in 1998 and ended in 2000.

The seven countries involved (Germany, France, Spain, Holland, Ireland, Italy and Portugal) assessed the performance rates of the electronic animal identification system, through the involvement of about a million heads of cattle, sheep and goats to which the three types of electronic devices were applied. Analysing the results of the experimentation, it was possible to compare the strong and weak points of the applications.

With reference to one of the more problematic aspects (resistance of the tag on the animal) ruminal cuds proved to last longer (85.9%) together with electronic auricular brands (82.1%). Conversely, injectable tags were used less frequently (61.7%) (4) because of the difficulties encountered in applying and removing them.

In fact, the ruminal cud proved to be the most reliable tool as it cannot be counterfeited, replaced or lost. It must however be applied only after weaning of the animal and the operation requires adequate preparation combined with skill to avoid causing harm to the esophagus. This system too, reveals some critical points, including difficulty in retrieving the capsule at slaughter.

On the other hand, the auricular brand is simpler to apply and does not require particular skills, however it is more subject to loss and/or replacements. The results of the IDEA project also revealed how sheep-goat identification systems could be considerably improved with the use of electronic identification systems. This led to the issue of Reg. (CE) no. 21/2004 (5), which establishes an identification and recording system of the species in question, involving the use, as second tool, of electronic radio frequency technologies, such as auricular brands.

Section 9 establishes that as from 1 January 2008 all animals born after 9 July 2005 must necessarily be identified in this manner. These aspects are better clarified in the subsequent Commission's Decision of

December 2006 (6), which specified the measures for implementing the above-mentioned Regulation.

The need to verify the real potential of RFId applications has led, especially on the national scene, to the development of initiatives in different sectors such as dairy, fruit and vegetables and wine growing.

The dairy sector, for example, is concerned by a series of pilot projects in the aim of concretely assessing the opportuneness of using RFId tags to identify the cheeses of each producer (7-8). In this sector, in fact, RFId is a potential tool for supporting the tracking system and protection against the imitation of agro-industrial products, especially in the cases in which DOP Brand cheeses are produced. The electronic label, placed during forming, can contain all the information concerning the product which, if they meet the provisions of Reg. (CE) 510/06, allow DOP certification. All this is done in view of warranting a safe product in the eyes of the consumer, who in this way can obtain truthful information about quality and origin without the risk of falling into so-called "food frauds", which over recent years have increasingly risen to the detriment of Italian products.

On this subject, in 2006 the Central Inspectorate for Quality Control of agro-industrial products -ICQ- (9) found about 13% of the over 27,000 operators controlled to be irregular. Specifically, in the milk-cheese sector, the products mostly controlled were for 83% cheeses, the main frauds of which concerned the commercial name evocative of productions recorded as DOP in generic cheeses as well as the omission of compulsory sale indications (such as producer's name and location). Consequently, in view of the presence on the market of non-compliant products or of doubtful origin, there is a strong need to use tracking devices that enable the improvement of these aspects.

On the other hand, the production chains of wine and fruit and vegetables have been involved by the ISMEA (*Institute of Services for the Agricultural Food Market*) in a series of experimentations (10) with the intent of promoting and informing about the recent information systems for tracking agro-industrial products.

The common element of these sectors is represented by the need to use technologies capable of improving and simplifying the collection, use and subsequent diffusion of the information associated with the product and its processing.

"*Vinop@ss*" is the ISMEA project in which wine estates that produce reference products with the DOC/DOCG brand took part; the inten-

tion was to handle control of the statements on the label in the best way possible, in primis with regard to the origin of the raw materials.

The "*Ortofruttap@ss*" experimentation involved companies operating in the fruit and vegetable sector, where it is very important to coordinate the various production stages to deliver the end consumer a high quality product, above all considering the fact that they are fresh, easily perishable products.

New tracking systems should therefore intervene in the logistic management of warehouses, as well as during procurement and delivery of the goods, in such a way as to enable unfailing data collection.

Method and results

This paper is the result of collaboration with the Gest-Cooper Soc. Coop. Agr. Consortium, which operates within Fedagri-Confcooperative Piemonte and provides assistance to the associated agricultural cooperatives for technical, administrative and commercial matters.

A survey has been conducted on voluntary certifications in the agro-industrial sector investigating, in particular, the subject of food safety and of the tracking methods used by the economic stakeholders of the sector. 104 farming cooperatives belonging to Fedagri-Confcooperative Piemonte were examined. The sectors investigated were milk-cheese (18 cooperatives), fruit and vegetables (39 cooperatives), breeding (18 cooperatives) and wine growing (29 cooperatives).

It was decided to analyse different production sectors to be able to get a comprehensive picture of the application potential of RFId and verify the state of diffusion of the technology among the various sectors.

The farms selected were given a questionnaire with the objective of defining the degree of knowledge and interest in RFId systems for the management of internal tracking processes.

In addition to the results of the survey, examples of RFId experimentations conducted by some farming cooperatives belonging to the sectors shown in Figure 1 are given below.

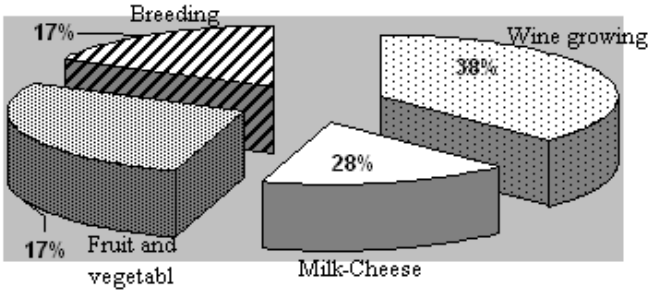


Fig. 1: Percentage of cooperatives involved in the survey; division by production sector.

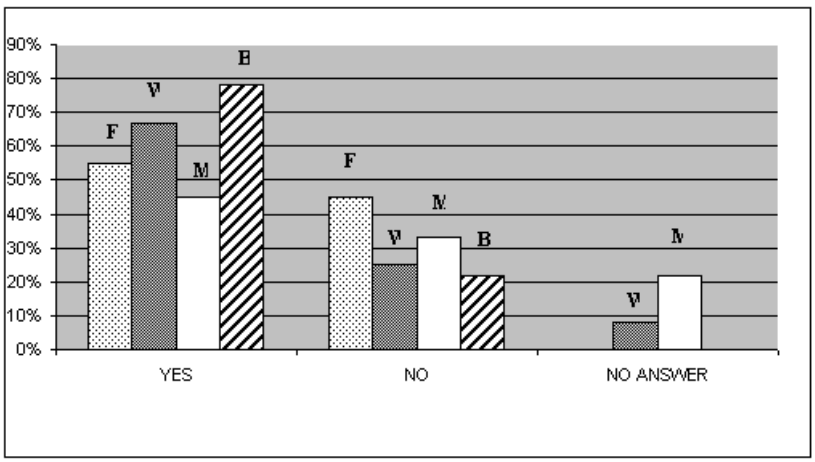
As may be deduced from Figures 2 and 3, the answers to the questionnaires reveal a good knowledge of RFId technologies and a certain propensity to further investigate the technical and applicative aspects of radio-frequency systems.

With regard to the fruit and vegetable sector it was shown that approximately 55% of the persons interviewed (Figure 2) is aware of the features and potential of the RFId system, while the remaining 45% gave a negative answer. Among those who said they were aware of RFId, however, no-one uses or expects to implement a system of this kind, as they already possess software and computer programmes that, at least for the moment, meet their requirements, mostly associated with correct warehouse management. On the whole, 59% of the farms interviewed said they were interested in getting to know, or possibly further investigating the features and potential of RFId.

The wine growing sector is very attentive to issues concerning tracking, safety and the control of the raw materials used. The results of the survey show the high degree of knowledge of RFId technologies (67% - Figure 2) and an equally high propensity to further look into the subject (42% - Figure 3), as "intelligent tags" are considered by most people a good alternative to the present ones and, above all, to barcodes. So, the answers given reveal a good predisposition to "technological" novelties in cellar management, particularly for the estates that produce DOC and DOCG wines and that are obliged to comply with strict production regulations.

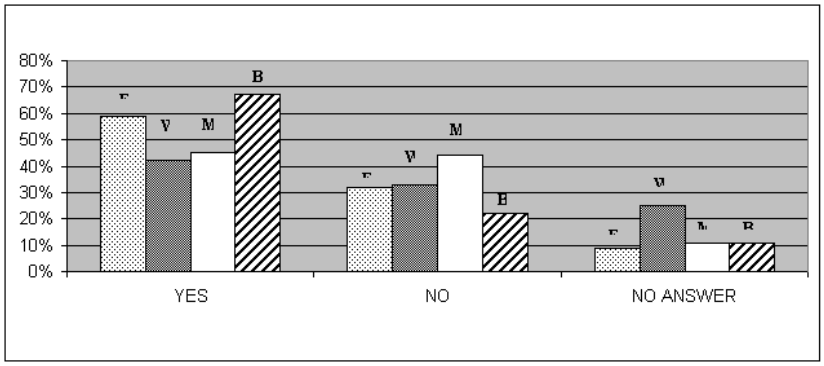
In the milk-cheese sector almost half of the persons interviewed know about RFId technology (45% - Figure 2), and about 44% is interested in further investigating the subject (Figure 3), because they see RFId technology as a helpful tool to protect their cheeses from possible imitations and guarantee the originality of the product for the end customer. The negative answers to the question about further investigating the subject depend on two main reasons: the first stems from the fact that the need does not exist to change the way of labelling products, while the second is referable to the type of production and processing of cheeses, which in many cases is unsuitable for the RFId tag.

The breeding farms are well aware of the features of radio-frequency systems (almost 80% answered the question positively - Figure 2), and the interest in gaining more information about its applicability to possibly be able to exploit its potential in various activities is clear (45% - Figure 3). The European regulation has certainly boosted these systems supporting the diffusion of them; in time sequence, the issue of the previously mentioned Reg. (CE) no. 21/2004 as already noted, is further confirmation that the way to be pursued for identifying animals is radio frequency.



F = Fruit and vegetables; W = Wine growing; M = Milk-cheese; B = Breeding

Fig. 2- Knowledge of RFId technology; division by production sector.



F = Fruit and vegetables; W = Wine growing; M = Milk-cheese; B = Breeding

Fig. 3 - Propensity to deepen knowledge of RFId technology; division by production sector.

Case studies

Some of the farms that said they knew RFId have already tested the applicability of the technology, for a limited period, within their production contexts. The purpose of these experimentations was to identify the strong and weak points of the technology in relation to the objectives that each production reality aimed to reach.

It was therefore decided to illustrate the more interesting projects, dwelling in particular on the results obtained: in fact, comparison with the present tracking systems can be helpful to improve the performance of the technology and limit critical points.

Breeding sector

Asprocarne Piemonte, an organisation of cattle meat producers that operates throughout the region of Piedmont, has recently carried out an experimentation on the possibility of replacing the identification system normally used on their animals with auricular RFId tags.

In the experimentation the Association has involved about one hundred heads of Piedmont breed cattle forming part of an open cycle bree-

ding farm. The idea of being able to use radio-frequency tags as an alternative to traditional animal identification systems stems from the need to improve certain operating aspects of the tracking process. At present, Asprocarne uses auricular brands and tattoos to collect all the information on the animal's life; therefore, the tracking system is based on the manual transcription of data and then reading and integrating them every time the need arises to do so. It is an advantageous system from the economic point of view (auricular brands are relatively cheap compared with tags), but requires much more time in terms of application, maintenance and updating the codes; for these reasons difficulties can be created should these devices deteriorate in use making codification of the information entered problematic (in fact, it can happen that adverse weather conditions like damp, rain, sudden changes in temperature…ruin the auricular brand of the animal).

Some studies (11-12) show that these systems can easily be altered or even forged, causing doubtless problems to the entire tracking system. The objective of the experimentation conducted was to see whether the RFId systems can overcome these critical points, making it possible to identify the animal unequivocally during its whole life cycle, thereby increasing the effectiveness of the present identification and recording systems.

The RFId technology used in this experimentation is formed of a passive transponder (type of tag that does not need an ad hoc battery to work, but is activated through radio-frequency waves directly by the reader) inserted in an auricular brand.

Once applied on the animals, the tag resisted for the whole duration of the test, it did not undergo any significant structural damage and did not require any particular maintenance.

Also the results obtained during data retrieving and updating were positive: there was a decided reduction of the time employed and it was possible to be able to carry out the operation without immobilising the animals.

To start the experimentation, it was necessary to change and rearrange farm procedures consolidated some time ago. In particular, a new operating software was introduced to support the RFId technology which however, in the case of Asprocarne, raised some critical points concerning the "management" aspect, especially for data entry and control.

Even if at the end of the test period these problems were not completely solved, programmes are available in commerce that suit this type of requirement.

In any case, against all this Asprocarne considers RFId a desirable solution for its production reality, even if it seems that the time in which it will be possible to see broad-scale diffusion is still remote. To be able to obtain the best results from the RFId system, all the links of the chain must be provided with the same tracking system, in order to enable the passage of information from the breeding stage up to marketing.

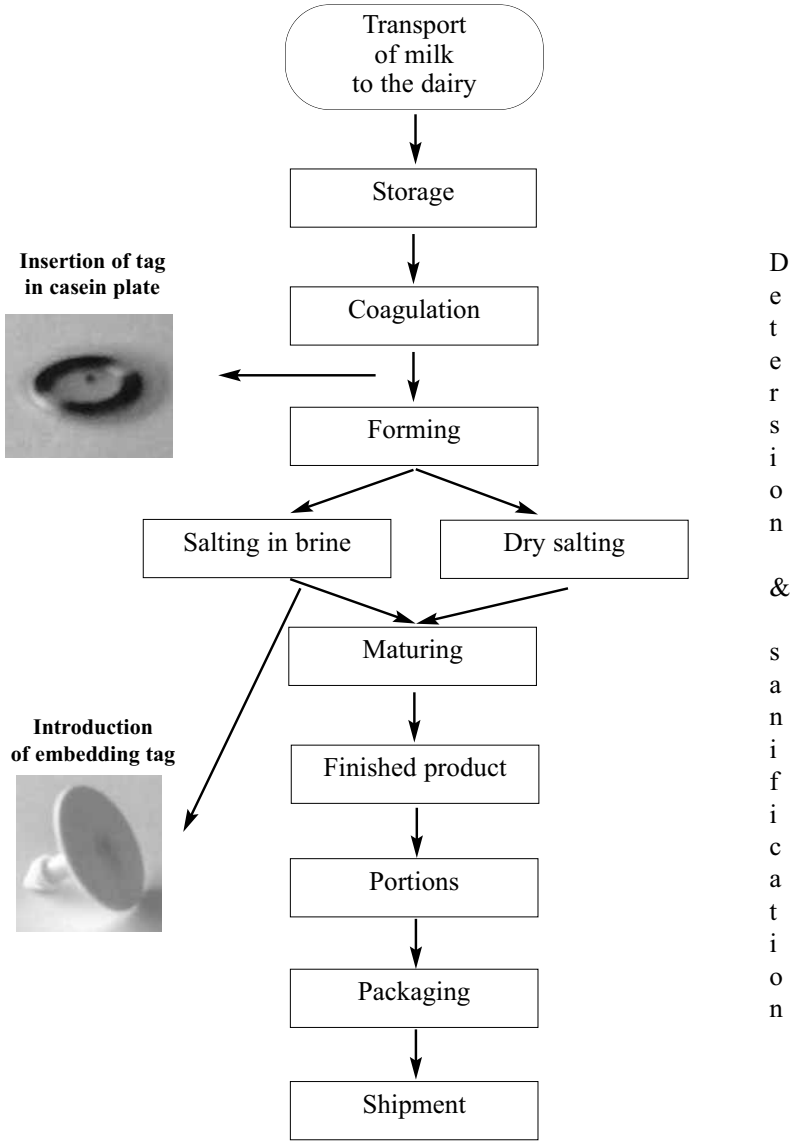
The next step that Asprocarne intends to accomplish is that of also using "intelligent tags" during slaughtering, and providing cuts of meat accompanied by an exhaustive label from the informative point of view. For the moment this still seems remote because, since Asprocarne does not have its own slaughtering point, it is still seeking a company willing to collaborate in the project: this helps to understand how it is still too difficult to succeed in coordinating a production chain from start to finish.

Milk-Cheese sector

Among the businesses interviewed, Caseificio Valle Josina Soc. Coop. Agr., with headquarters at Peveragno (CN), is aware of the future potential of the application of RFId. Exactly for this reason it has conducted an experimentation c/o its factory. This experiment began in October 2006 and ended in December of the same year. Among many reference products, this firm produces four cheeses with Protected Denomination of Origin (DOP), namely: Bra Tenero DOP, Bra Duro DOP, Raschera DOP and Toma Piemontese DOP.

The main purpose of the experimentation was to verify the applicability of radio frequency in the production reality of the cheese dairy, to boost the current tracking system in the aim of monitoring the quality of the products and avoiding cases of imitations.

The dairy decided to use two different types of small-sized RFId tags and compare the data obtained at the end of the experimentation; an embedding tag to be inserted directly on the side of the cheese at the end of the forming process while the other is inserted in a casein plate, to be placed during forming after the first or second turning over of the cheese.



Key: POSSIBLE STEP: NOT PRESENT IN ALL TYPES OF PRODUCTS

Fig. 4 – Introduction of RFId technology in the production flow of "Valle Josina" Cooperative.
Source: Tracking sheet – Gest-Cooper.

The results obtained after 60 days of use of the tags were satisfactory. Positioning of the tags was easy for both types and also data coding. The embedding tag proved to be more resistant during the various stages of processing, while the casein plate got lost in those cases in which the cheese has a "rough"/uneven rind (for example Castelmagno).

Conversely, the embedding tag, owing to its shape similar to a nail, firmly adhered to the cheese and firmly resisted the stresses during the various processes. In this type of tag, however, the dimensions ought to be further reduced, to avoid spoiling the cheese during its insertion. It should be pointed out that the size of the tag does not in any way affect the amount of data it can contain: this aspect depends solely on the memory extension of the chip which varies, generally, from one bit to many Kbits. In any case, some information can also be entered in the PC storage, and then be called up at the time of reading the tags.

Costs proved to be high (about one Euro per tag) but it is also necessary to consider the limited number of pieces bought at this stage; indeed, the cost of the tags is inversely proportionate with the size/amplitude and continuity of the supply, as also proved by a study conducted by the Milan Polytechnic Observatory (7).

TABLE 1

COMPARISON OF COSTS OF RFID TECHNOLOGY

		Unitary Cost			
		Low volumes		**High volumes**	
HF	Tag only (chip+aerial+inlay) 90x140 mm	1,000 pieces	€ 0.60	1,000,000 pieces	€ 0.25
	Tag in 30 mm diameter plastic button	1,000 pieces	€ 1.50	1,0000 pieces	€ 1.25
	Access control station	10 pieces	€ 450.00	100 pieces	€ 400.00
	HF long range reader	5 pieces	€ 3,000.00	50 pieces	€ 2,700.00
	HF long range aerials	10 pieces	€ 600.00	100 pieces	€ 500.00
UHF	Tag only (chip+aerial+inlay)	1,000 pieces	€ 0.20	1,00,000 pieces	€ 0.15
	Solo tag (chip+aerial+inlay) high performance, omnidirectional, good capability also in applications RF-hostile material	1,000 pieces	€ 0.45	1,000,000 pieces	€ 0.30
	Tag on metal, application on metal bins for internal logistics	10 pieces	6.00	1,000 pieces	€ 4.50
	UHF medium range reader	5 pieces	€ 2,800.00	50 pieces	€ 2,500.00
	UHF aerials, circular polarisation	10 pieces	€ 300.00	100 pieces	€ 250.00

Source: Milan Polytechnic, RFId in the search of value-2007 Report.

In addition to the cost of the tag, the cheese dairy had the expense for the PC equipped with software for reading and possibly rewriting the electronic device: in this case, the cost depends on the functions required. Satisfied with the results obtained, the dairy has set the further objective of creating an RFId tracking system to accompany the form of cheese up to the sales counter of its shops, suitably equipped with software. This way, the consumer has the possibility to check the production route followed by the cheese bought, simply placing the tag near a special reader. This way the cooperative improves communication with the end customer, transmitting not only data and information associated with tracking, but also curiosities, nutrition information, suggestions and anything else that can be helpful to the buyer.

Fruit and vegetable sector

The questionnaires revealed that in the fruit and vegetable sector there is still little knowledge of the technology and perhaps, also for this reason, the application of RFId within the associated processes is finding it hard to take off.

Analysis of the production process of a fruit and vegetable company reveals that the functional management of the warehouse is of considerable importance, as this is where the fruit is taken and where, while waiting for processing, it is kept in special bins, that represent the base unit for filing the goods. To organise a correct tracking system, therefore, it is fundamental to indicate the basic information on each of these containers like the origin of the fruit, the variety, main characteristics …, information that must be retained also during storage and transport.

Warehouse logistics plays a crucial role within a fruit and vegetable company and the solution hypothesised to improve the management of it is that of fitting the bins with an RFId tag in which to be able to record the main operations performed during the production cycle, to speed up goods handling and place a product on the market accompanied by all the necessary information.

A cooperative firm that operates in the province of Saluzzo, La Frutta Soc. Coop. Agr., has thought of exploiting the potential of RFId within its production reality, introducing an electronic tagging system involving the entire company process, from conveyance of the goods, to the management of warehouse logistics up to the marketing of the finished product.

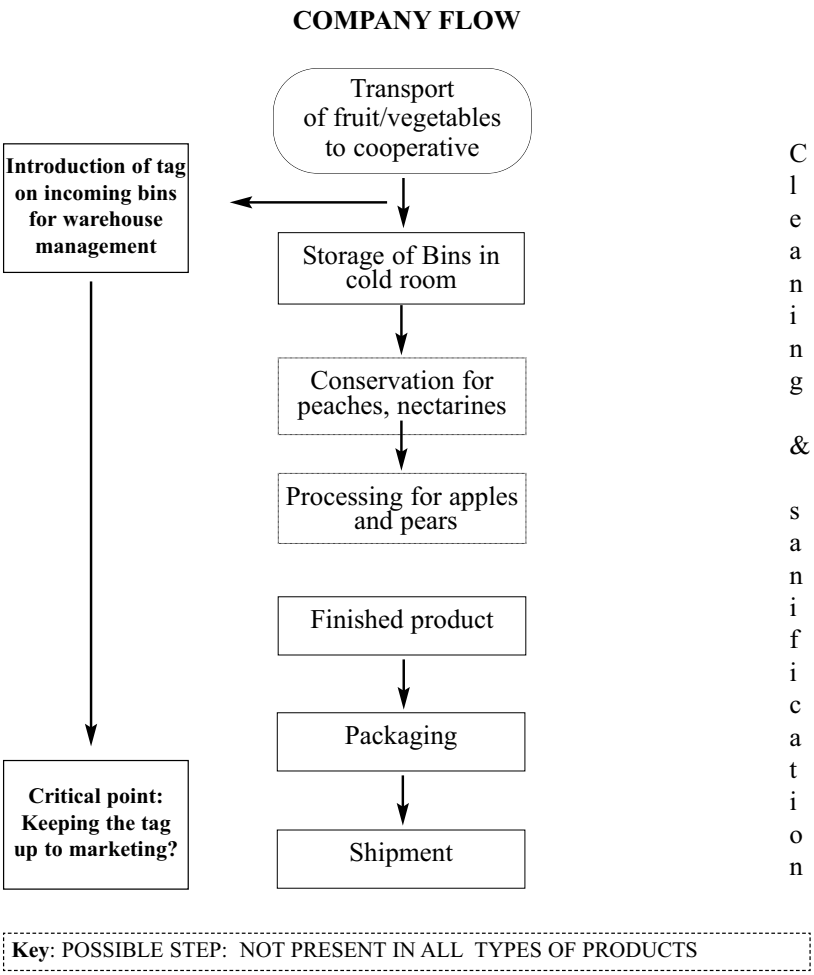


Fig. 4 – Introduction of RFId technology in the production flow of "La Frutta" Cooperative.

Source: Tracking sheet – Gest-Cooper.

In truth, the experimentation stopped at planning and was never started because already during the planning stage a number of critical points were noted that left the warehouse managers rather sceptical on an effective improvement compared with the system used previously. A first destabilising item was the cost (approx. 1-2 € per tag), rather high conside-

ring the large number of bins in a warehouse. Secondly, the technological architecture at the base of how the tags work would have called for considerable investments also to set up ad hoc instrumentation in the warehouse, as the existing devices prove to be unsuitable. The firm also needs to have tags with a very high resistance: they must adhere perfectly to the bins (which can be made of various materials, like wood or plastic), be able to work also at low temperatures like those recorded in the processing rooms, and never lose the signal or memory under any circumstance. In addition, to correctly handling receiving of the fruit loads, in the truck entry area a special platform would have been necessary for recognising and sorting the goods transported, but, in its present location, the company does not have a sufficient truck manoeuvring area.

The incentive to adopt an RFId tracking system is further reduced by the fact that Organised Large-Scale Distribution (GDO) currently requires other types of labels from its suppliers, which are cheaper than RFId and above all quicker to apply on fruit bins.

In this case, too, the implementation of an RFId system necessarily requires the previous or next link of the production chain to have a similar technology. Unfortunately, an integration of this kind is still far from being developed, as the company has a large number of partners who do not all seem interested in changing their tracking system.

Conclusions

Food companies find themselves working in an increasingly complex market, where the regulations concerning the operating standards to be followed are continuously evolving. Thus companies are required to have a high degree of efficiency aimed, ultimately, at offering the end consumer a product that meets the requirements of the law.

The food scandals that have hit the sector over recent years (BSE, bird flu…) have undoubtedly raised the warning threshold of producers, directing them towards a consumer protection policy. Therefore, in this sense, it is fundamental for businesses of the agro-industrial sector to warrant a more complete food tracking system, according to the provisions of Reg. (CE) 178/2002.

Over the past few years information technology has been providing many tools to ensure improved management of this delicate process. RFId is one of the new proposals appearing on the market; the versatility of this application is witnessed by the fact that it is used in the most varied

fields, from access control to warehouse internal logistics, from ticketing to payments. In the food sector, use arises from the need to find a system to improve the management of tracking along the production chain and protect the consumer against untrue claims on the product.

The case studies presented belong to the Piedmont agricultural system and offer a series of points for reflection on the state of the art of RFId applications. The companies described operate in different sections and each has developed different expectations with regard to the applicability of the technology in their field of production.

However, though the intentions are different, all three cases revealed critical points such as the cost of the technology, still rather high, and the slowness of applying the tags compared with conventional labels. These reasons are the main restraint to the adoption of RFId systems. To minimise the economic impact of the application, research projects are currently under way to replace the passive silicon and copper tags with components made with conductive polymers (13), but the reduction of costs depends also and mainly on the trend of the demand and supply of the technology on the market.

It is worth focussing on another aspect revealed during the various experimentations: the impossibility of creating an integrated production chain, capable of stimulating collaboration among the various subjects from "start to finish". In the case of Asprocarne, for example, the experimentation was unable to continue because no link following the breeding stage adopted a technology capable of allowing the flow of information up to the end. A similar matter took place for the fruit and vegetable sector: in this case, the company adjusted to the tracking system required by the GDO, which for the moment does not require its suppliers to use an RFId system. Conversely, this type of problem did not occur in those contexts (as in the case of the Valle Josina Cooperative) in which the business has its own sales outlet fitted with suitable equipment to be able to receive the information from the tag, and in turn, transmit it to the buyer.

The case presented in the fruit and vegetable sector, in fact, revealed how RFId technology is still unable to meet the real requirements of the firm, offering interesting points of reflection to improve its structural design.

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