

Traceability - an important step in food safety

Oana-Raluca RUSU, Iuliana MIHAI, Viorel-Cezar FLORIȘTEAN, Alina BORȘ,
Cristina RÎMBU, Mariana GRECU, Luminița-Iuliana AILINCAI, Gheorghică VLAD

University of Applied Life Science and Environment and Veterinary Medicine „Ion Ionescu de la Brad”

raluca.rusu@uaiasi.ro

Abstract

Traceability is a topical issue used in the food processing industry, ensuring the economic operator the safety of purchasing raw materials from the external and internal market for their transformation into safe food products that reach the consumer's table. Traceability also emphasizes customer brand protection requirements. Traceability and withdrawal procedures are currently the most important in every segment of the food industry, as it must be ensured that their traceability efforts are at the highest standard to protect the brand image on the market. These growing requirements are pushing food processors to maintain traceability upstream and downstream in the supply chain. Given the expansion of the global market and the speed with which goods move around the world, it is understandable that the authorities are increasingly concerned with developing rules on traceability. There are priority approaches in the field of food, which have the greatest impact on consumers, given the frequency of consumption and the imperative nature of the need for food. , respectively: European Food Safety Authority - EFSA (Europe) and the National Sanitary Veterinary and Food Safety Authority - ANSVSA (Romania) [12,13].

Key words: traceability, food safety, consumer safety

Introduction

The European food safety system is everyone's responsibility, from the economic operator to the final producer and consumer, so the quality and safety of food must be based on the efforts of all people involved in this complex process that begins and ends. By the time they reach the table, to the consumer [6,7]. In the food industry, throughout the technological processes, various procedures and control mechanisms are implemented, which ensure the consumer that the food that reaches his table, is edible and that the risk of contamination is reduced to a minimum [1]. However, we cannot talk about a zero risk in food and that is why European legislation and the best process management systems cannot fully protect us. An important step in the food safety system, through which end consumers can be protected from the harmful effects that may occur from the existence of contaminated food on the market, is traceability.

Research on traceability has specifically focused on tracking the animal from calving, including offspring, to finished food, to check the risk of animal diseases, to track food shipments, to reduce the risk of handling and for consumer information systems on the attributes of food. such as animal welfare, country of origin and genetic composition [8]. Given that the food market has expanded worldwide and the speed with which goods move from one part of the world to another, it has increased the attention of the authorities to develop rules relating to traceability. is a hazard management device that allows experts to withdraw or review items that have been identified as hazardous.

Thus, there are priority approaches in the field of food, which have the greatest impact on consumers, given the frequency of consumption and the imperative nature of the need for food. Past food crises have revealed that documents kept on file are not always sufficient to allow full traceability of suspicious foods. During the implementation of Regulation (EC) no. 178/2002, Regulation (EC) no. Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin and Regulation (EC) No 853/2004 854/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific rules for the organization of official controls on

products of animal origin intended for human consumption, experience has shown that food business operators generally do not have the necessary information to ensure that their systems for identifying food handling or storage are adequate, in particular in the food sector of animal origin. This situation has led to significant economic losses in this sector which could have been avoided and which were due to the lack of complete and rapid traceability of food [9,10,11].

Therefore, certain rules have been laid down for the specific sector of food of animal origin in order to ensure the correct application of the requirements laid down in Article 18 of Regulation (EC) No 1234/2007. These rules should allow (to some extent) flexibility in the format in which the relevant information should be made available. Each country has a set of specific rules, very dynamic in evolution, which emanate from specialized bodies. In the case of European countries, care is taken to align these rules with the relevant European regulatory framework. At European level, there are two reference rules for traceability:

- Directive 2001/95 / EC of the European Parliament and of the Council of 3 December 2001 on general product safety) and

- Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, applied from 15 January 2004 and 1 January 2005, respectively, in all Member States of the European Union. The provisions of the Community Regulation no. 178/2002 are taken over in Romania, entirely by Law no. 150 / 14.05.2004.

In addition to the legislative forms perceived at European level, traceability is also managed by the quality standards, 22005: 2007, ISO 22000: 2005 and ISO / TS 22004: 2006 on traceability in the food chain. Complementarily, at regional or branch level there are other initiatives, such as: International Food Standard (IFS), founded in January 2003 by several important names in German retail to unify the procedures in the field and to provide transparency to the entire food chain. supply; subsequently, companies/associations from other European countries joined. The British Retail Consortium (BRC) is a global food standard that includes information on guidelines for meeting HACCP standards, quality and document management, and control and transparency in the food industry. FPA-SAFE-Standard (Food Products Association / Supplier Audits for Food Excellence), is a voluntary, industry-independent supplier audit program to create transparency and efficiency in production.

Traceability has developed as a concept, within the quality system. Although it is a notion that appeared before the 1990s, the importance given to traceability has increased considerably, especially in the food field, in the last decade. Traceability was defined in 1987 according to the quality standard ISO 8402 and ISO 9000/2000 as "the ability to find the history, use or location of an entity using registered identifications." The aim of developing traceability was to increase safety and security in the food chain and to establish a model for traceability, acceptable for the supply of raw materials, food manufacturing, trade and consumption. In this sense it is necessary to define two essential notions: traceability and traceability system (*Fig.1*)

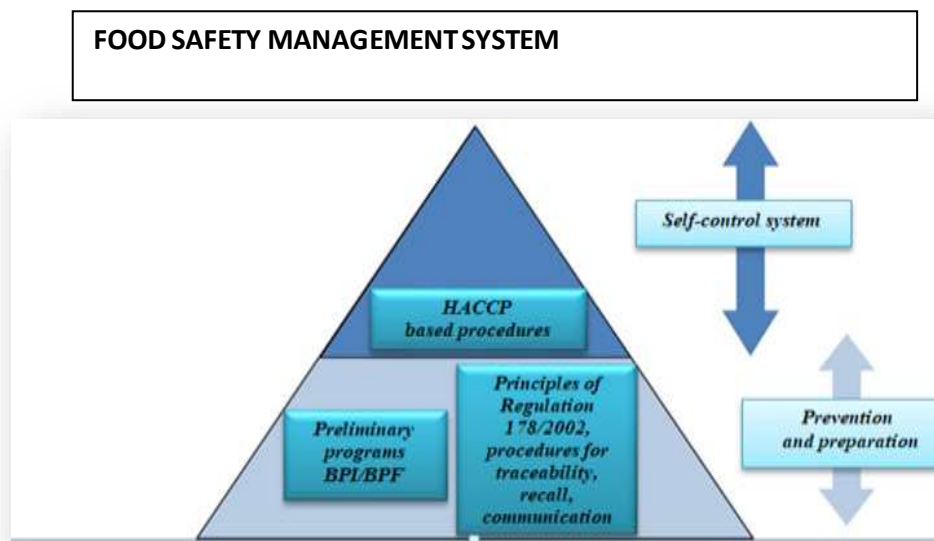


Fig 1 - Elements of a food safety management system

(taken from the Commission Communication on the implementation of food safety management systems comprising Preliminary Programs (PRPs) and procedures based on HACCP principles, including ease/flexibility of implementation in certain food companies C / 2016/4608)

Traceability is defined as the ability to identify and track, throughout all stages of the production, processing and distribution of food, feed, animal intended for food production, or a substance that follows, or which may be incorporated into a food or feed - EC Regulation 178/2002. The traceability system represents the totality of data and operations capable of maintaining the desired information about a product and its components during a part, or of the entire production and use chain (according to SR.EN.ISO22005).

Traceability, as formulated and used in the practice of food production, is a key element of transparency and allows tracking a product on its path from raw material to exposure for marketing, including the consumer and therefore, the flow of a food product by identifying and tracking the accent with documentation. Article 18 of Regulation 178/2002 of the European Parliament states the traceability requirements: The traceability of a food, feed, food-producing animal and any other substance which is intended or expected to be incorporated into food or feed must be determined at all stages of production and processing.

Food and feed operators must identify any person from whom the supply of food [2]. feed, food-producing animals and any substance to be incorporated into food or feed has been made, and must also have systems/procedures in place that will allow that the information be made available to the authorities requesting it. Food and feed business operators must have systems/procedures in place to identify other operators to whom these products have been delivered. The information will be provided to the competent authorities at their request.

Foods/feeds that are placed on the market or that will be placed on the market within the European Union will be appropriately labelled/identified to facilitate their traceability. According to Regulation 178/2002, the main responsibility for ensuring the compliance of food/feed at all levels (production, processing and distribution), belongs to the economic operator.

Product traceability is an effective means of identifying health problems, isolating contaminated products, reducing the risks of intentional contamination and food fraud.

Traceability can be applied:

1. For foodstuffs, where the traceability system links the raw materials, their origin, processing, distribution and location after marketing.
2. For data, where the traceability system refers to calculations and data along the quality path and through which a link is made with the initial quality requirements
3. In calibration, where the traceability system refers to the equipment for measuring physical quantities or properties or with reference to materials included in national and international standards.
4. In IT and programming, where the traceability system refers to the design and implementation of processes in accordance with the system requirements According to CAC 60-2006 (CAC = Codex Alimentarius Commission), respectively in the ability to track the movement of a food product in different specific stages of production, processing and distribution.

The composition of the traceability system in the food field involves the joining of a series of entities that are alternated by stages that are identifiable in the realization and circulation of a good. In REGULATION (EU) NO. 931/2011 OF THE COMMISSION traceability requirements refer to:

- Food business operators who must ensure that information on consignments of food of animal origin is made available to the economic operators to whom the food is supplied and, on request, to the competent authority;
- An accurate description of the food;
- The volume or quantity of food;
- The name and address of the food business operator from whom the food was dispatched;
- The name and address of the consignor (owner), if he is other than the food business operator from whom the food was dispatched;
- The name and address of the food business operator to whom the food was sent;
- The name and address of the consignee (owner), if this is other than the food business operator to whom the food was sent;
- A batch or transport identification reference, as appropriate;
- The date of dispatch of the food.

The information referred to in this Regulation shall be made available in addition to other information required under the relevant provisions of Union legislation on the traceability of food of animal origin, and shall be updated daily and kept at least up to date. in which it can reasonably be assumed that the food in question has been consumed. At the request of the competent authority, the food business operator shall provide the requested information without undue delay.

The appropriate format in which the information is to be made remains at the choice of the food supplier, it must be clear and obtainable by the economic operator to whom the food is supplied.

Ensuring traceability within a distribution chain (composed of entities and stages) means associating an organized (systematic, rigorous) flow of information for each link in the chain; the link consists of the two entities placed at the ends of a stage (route sequence) and the space between them (distance in time and space from one entity to another). Each entity in the distribution chain belongs both to the upstream stage (where the raw materials/products/inputs come from, etc.) and to the downstream stage (where the products/goods/process results go). This means that at any of

the entities in the route of a distribution chain will be recorded data from the previous stage ("input data"), from the stage carried out at that entity ("own data") and data related to the subsequent stage ("data"), output.

On the traceability side in the food industry, great emphasis is placed on risk analysis, more precisely on biological, physical, and mechanical hazards, which may occur in the composition of a food product in the technological flow, in certain stages of its processing.

In 2016 in Germany about 50% of food products withdrawn from the market, this situation being similar internationally. The product withdrawn from the market was minced meat in which pieces of plastic were identified. If there is a threat to recall the products in large companies, they must know exactly where and to whom they delivered the products [14].

That is why the EU is involved in "solidifying" the legislative part on the traceability side, especially in the food field, where the main pawn that can be directly affected is the consumer. For this purpose, only 5 important steps can be followed regarding the transparency of the food market supply (warehouses, supermarkets, processing units, etc.).

The 5 steps are represented by:

1. Defining food target groups

In some companies in the food industry, a good concept of traceability with clearly defined objectives can be a success. First, it will be followed and determined what is the real situation within the respective company/unit, the points will be identified where there could be a risk of contamination of the products and the measures that must be taken to reduce it. Thus, this aspect will be taken into account when making this traceability system for each food product. There is a need for more security in the food sector, in order to recall from the market the products that constitute a real danger for the consumer. In creating a team on traceability, the emphasis is primarily on IT staff, on the staff in the department of production and quality assurance, as well as members of management.

2. Defining the dimensions of the lot/lots

The quality of traceability depends on the definition of the lot and the size of the lot. Smaller and more homogeneous batches allow a more precise traceability process. However, in units that work with smaller and more homogeneous batches, the traceability system can be better kept under control, the work processes associated with data entry lead to increased costs. Therefore, when defining or restricting batches, experts recommend a compromise between individual risk management on the one hand and profitability on the other. A frequently sensitive and internationally proven practice is the formation of day batches or smaller batches. The more advanced general recommendations are less sensitive because the differences in the organization of the structure and organization chart in companies are too large. An example: milk from large-scale agricultural operations, which is marketed and distributed through a single dairy farm, can be more easily tracked, despite the large batch size than organic cheese produced in small batches, which is marketed through organic shops specialized.

3. Selecting the type of traceability identification of a product

The precondition for complete traceability is the identification and clear identification of the products concerned - ideally automated. This is only possible with the right tools, such as identification numbers, barcodes, or RFID according to GS1 standards. Common standards in this context are GS1 128, transport unit number (NVE or SSCC), and EPCIS. The receipt of the goods is decisive for all subsequent identification processes. Ideally, the raw materials received are already identified by the supplier. Otherwise, the goods should, for example, receive a GS1 128 upon delivery. It lays the groundwork for the transfer of information from stock, production, packaging, and prices borne by IT to the collection. In principle, traceability documentation is also

possible on paper. However, with the increase in production volume, the number of departments involved, and the people involved in the documentation process, and a large number of batches of raw materials in the product, the documentation requirements are also increasing.

4. Recording the correct data in the right place

The organization of traceability becomes more complicated whenever different batches of raw materials are mixed in food production. Here new batches are formed which must be administered and passed to the next steps in production or packaging. For this reason, it is recommended to install on the technological flow, devices for capturing IT data, which can be processed online later. Regardless of the type of device used (mobile terminals, computers, barcode readers), it is important that the data be passed directly into the process. Only in this way can you perfectly ascertain which batch and which ingredient were introduced into the finished food product. This includes documentation of the processing quantities re-entering the production process. By capturing and examining data at all levels of production, problems can be detected quickly and even avoided before a process failure occurs.

5. Using data and creating added value

Each traceability system is as good as the quality of its data. Finally, it is about the possibility to analyze and visualize the data with the software established by the company/food processing unit, and only then can the recall processes be organized and automated effectively - which to a certain extent it is already required by EU legislation, directives, and audits. In addition, the obligation to provide supporting documents at the push of a button may be fulfilled, indicating that the attributes of the product printed on the labels are correct.

The significance of traceability systems will certainly continue to increase in the future. In EU countries, many companies are already transferring their data to consumer information systems. These databases will most likely play an international role. In this case, traceability will not only provide relevant added value for sales but will also become a basic requirement to participate in business relationships in the first place. Finally, traceability systems also offer a huge opportunity to optimize and benefit from processes as well as from an economic point of view. Purchasing optimization, up-to-date stock information, secure planning bases, meaningful evaluations and statistics, accurate batch calculations - these are all things that companies in the food industry will ultimately benefit from.

The system is called, in practice, "a step forward, a step back". At a certain degree of development of the activity, the flow of information on the movement of goods is subject to a separate management, the manager being even independent of the entities that are involved in the distribution chain.

Under these conditions, in practice, but also in the specific literature, several types and categories of traceability have been established:

- Traceability (upstream): searching for information prior to a reference moment (in the opposite direction to the route and time flow); commonly referred to as "backward traceability";
- Traceability (downstream): searching for information subsequent to a reference moment (in the direction of the route and the flow of time); often referred to as "forward traceability";* internal traceability; searching for information at the level of the reference entity, where one or more operations on the goods took place (processing, preservation, etc.);
- Product traceability: following the aspects related to the product (transformations, characteristics, quality) and at the time and place of a non-conformity - suppliers, transport, own space; it is also called qualitative traceability;

- Logistical traceability: tracking aspects of an accounting nature - quantitative compliance, specifying suppliers and beneficiaries;
- Data traceability: tracking data quality (consistency, accuracy, clarity, integrity) and compliance of data recording;
- Close traceability: specific in the case of continuous flows of goods, for which it is significant to follow the movement of goods on short sequences of time and space and which ensures the knowledge of the links between the lots that make up the supply flow;
- Track and trace (or tracking and tracing): process of determining the current and past places (and other information) of a good in a distribution chain / logistics process.

In developing a food chain traceability system, it is necessary to identify the specific objectives to be achieved, such as:

- a) To support food safety and/or quality objectives;
- b) Meet the specification of the beneficiary;
- c) To establish the history or origin of the product;
- d) To facilitate the withdrawal and / or recall of products;
- e) To identify the responsible organizations in the food chain;
- f) To facilitate the verification of the specific information regarding the product;
- g) To communicate information to relevant stakeholders and consumers;
- h) To comply with any local, regional, national or international regulations or policies, as the case may be;
- i) To improve the efficiency, productivity and profitability of the organization.

If an organization participates in a traceability system with other organizations, the elements must be coordinated. Links must be established in the food chain because each organization identifies its immediately previous source and its next recipient.

Applying the principles of traceability to the food supply chain, allows specialists to monitor food and know the transformations undergone "from the farm to the fork" In the context in which in recent years we have witnessed several incidents regarding the origin of some food products, both at national and European level, traceability, based on Romanian standards that adopt European and international standards, is a solution that guarantees food safety and implicitly consumer safety.

Conclusions

1. Traceability along the food chain is an important tool for ensuring food safety. European Union regulations require every actor involved in the food chain to be able to identify both the origin of the raw material used and the destination of its final products along the food chain.
2. The actor involved must be able to demonstrate what raw material he used and in the manufacture of which the final products were included.
3. The European Union does not establish a specific system or program for traceability. Food business operators have the responsibility to develop and implement evidence and traceability systems to meet the standards set in the European Community.
4. Producers, processors and distributors, as well as food safety experts, should be kept informed of future developments in this field, in order to help them implement traceability systems appropriate to their areas of activity.

Bibliography

1. Aung, M. M., Chang, Y. S. (2014). Traceability in a food supply chain: Safety and quality perspectives. *Food control*, 39, 172-184
2. Commission, E. (2002). Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. *Official Journal of the European Communities*, L31, 1-24.
3. Communication from the Commission on the implementation of food safety management systems including Preliminary Programs (PRPs) and procedures based on HACCP principles, including ease / flexibility of implementation in certain food businesses
4. Commission Implementing Regulation (EU) No 931/2011 of 19 September 2011 on the traceability requirements set by Regulation (EC) No 178/2002 of the European Parliament and of the Council for food of animal origin.
5. Ghid de bune practici pentru autoritățile piețelor en gros din UE – Ediție revizuită, noiembrie 2009 © 2003-2009 WUWM;
6. Gandino, F., Montrucchio, B., Rebaudengo, M. & Sanchez, E. R. (2009). Opportunities and constraints for wide adoption of RFID in agri-food. *International Journal of Advanced Pervasive and Ubiquitous Computing*, 1(2), 49-67. (9)
7. Nambiar, A. N. (2010). Traceability in agri-food sector using RFID. *Information Technology (ITSim)*, 2010 International Symposium in Kuala Lumpur, 15–17 June 2010, 2, 874-879.
8. Panghal, A., Chhikara, N., Sindhu, N. and Jaglan, S. (2018). Role of food safety management systems in safe food production : A review. *J. Food Safety*. e12464.
9. Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs.
10. Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for food of animal origin
11. Regulation (EC) No 854/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption
12. <http://www.apc-romania.ro/ro/i-ce-trebuie-sa-stim-despre-trasabilitate/NDA0LTA.html>
13. http://ec.europa.eu/food/intro_en.htm
14. (<https://food-blog.csb.com/us-en/five-steps-to-traceability>).