
RISK ASSESSMENT MATRIX FOR FOOD SAFETY

Stancu Alina¹, Antohe Radu² and Suvorov Nicolae³

^{1) 2) 3)} *The Bucharest University of Economic Studies, Bucharest, Romania*

E-mail: stancu.alina.madalina@gmail.com; E-mail: radu.antohe@yahoo.com

E-mail: suvorov.nicolae@hotmail.com

Abstract

In recent decades, the agri-food sector study has been based on the analysis of commodity exchanges, while in the current period it is replaced by the study of the product line, focusing on the agents involved in each phase of the chain, but also on the material operations that trigger these changes and highlight the tendency for more and more products not to reach the final consumer in their natural state, which are often processed.

The foundation for the development of a viable society brings to the forefront the quality and safety of food and products marketed by any approved establishment. The new EU vision focuses on extending this concept across a country's borders, ultimately encompassing regional structures around the world. Therefore, the value of food across the European area will be the first in making decisions of any kind on compliance with food quality and safety standards.

In view of the above-mentioned aspects, this paper aims to identify and analyze the risks in critical control points across the food chain so that they can be reduced to the minimum threshold

Keywords

Risk assessment, Food safety, HACCP System

JEL Classification

Q18, Q12, I12

Introduction

The foundation for the development of a viable society brings to the forefront the quality and safety of food and products marketed by any approved establishment. The EU's new vision focuses on expanding this concept across the borders of a company or even a country, eventually ending up with regional structures around the world. Therefore, the value of food across the European area will be the first in making decisions of any kind on compliance with food quality and safety standards.

Another important aspect of the quality concept, which is defined as the summation of all the features that will be included in a standard generated by the European Commission and which requires them to be respected, is consumer-oriented quality. In this respect, the consumer will establish the quality criteria and not the manufacturer because demand is the one that generates the offer and the manufacturer will be able to meet the safety and quality standards to meet the consumer's requirements. Consumers' needs evolve in relation to technical and material developments at a global level and directly proportional to scientific progress.

The quality of pork meat is influenced by certain decisive factors of aesthetic and organoleptic nature and among them we can list:

- Quality of raw materials for processing.
- Feed quality of animals.
- Personnel qualification level.
- The degree of technology of the processing unit.
- Quality of genetic material.
- Commodity circuit on the distribution chain.

These issues may or may not improve the quality of the finished product, be it processed, packaged and conditioned or sold as such.

In addition to the factors listed above, the product that reaches the final consumer is directly influenced by the management strategy adopted within the company and by the degree of organization of work within the social framework. Facilitating decision-making, promoting a quality management system and optimizing the relationships between all the economic agents involved in the production process at each stage of the process is the essence of research over the last 30 years with a strong strategic focus. Consumers are becoming more and more aware of their needs, and hygiene requirements across the production-distribution-marketing chain are becoming increasingly complex.

Literature review

Over the years, specialists have defined the agri-food chain in a number of ways but with a common meaning, representing a succession of stages achieved to achieve the objectives and the aggregate of the unified agents in the same activity.

In 1968, Goldber defines the agri-food chain as the totality of economic agents involved in the production, transformation and marketing of a product. 20 years later, Malassis says that the agro-food line represents the itinerary traveled by a product or group of products within the agro-food system.

The French economist Malassis proposes a classic approach to the study of the agri-food sector, which distinguishes between sectoral and agricultural branch concepts. It defines the sector as the group of enterprises that carry out a joint activity, namely the activity which contributes most to the formation of turnover.

In 1960 Clark proposes a model of 3 sectors: the primary sector that includes agriculture, forestry, mining and fishing, the secondary sector that is represented by industry and the tertiary sector that includes transport and services. Current approaches to the classification of sectors of the economy are proposed and the quaternary information sector.

Research methods

For a better understanding and analysis of the risks at each stage of the agro-food chain it is necessary the fundamental theoretical research of the specialized literature regarding the possibility of occurrence of different risk factors. Also, for the implementation of preventive measures, it is necessary to research the current food safety standards, as well as the HACCP system (Hazard Analysis and Critical Control Point).

Analysis of Critical Control Points

Currently, each production or marketing establishment is bound by European requirements to practice an exceptional management system. This system is called HACCP and is a systematic method of preventing, evaluating and controlling risks that occur in the production process. The HACCP system will be deployed across all departments of the company, where specific activities such as analytical checks, quality control, technological flow control, corrective action, etc. will be carried out. All these activities, as well as the implementation of this management system, lead to the achievement of a finite product that

conforms to the requirements of the consumers that meet the hygienic and sanitary requirements as well as the technological ones.

The first stage of the HACCP system relates to risk analysis to identify, assess, prevent and correct any mistakes that may occur in the production process as a result of the human or natural factor. Risks may be of a physical nature (foreign bodies on the surface or in the composition of the product at any stage), chemical (chemical residues from outside or inside the production unit) and biological (the presence of pathogenic or non-pathogenic microorganisms on the surface or in composition of the product).

The second step of the HACCP system is to identify the Critical Control Points that are represented by each stage of the production process over the entire technological stream from raw materials to the finished product that reaches the final consumer. In the literature, there are two types of CCP (Critical Control Point), one in which risks can be prevented and eliminated, and one in which risks can only be reduced without being completely eliminated. Not only why CCP is concerned, both must be kept under control within the limits set by the relevant standards.

The four stages of the meat industry are: preproduction stage, production stage, processing stage and distribution stage. At these stages, risk analysis will be conducted on the following critical control points:

1. Obtaining raw materials.
2. Transport.
3. Obtaining the carcasses and appreciating their quality.
4. Packaging and conditioning.
5. trade.

The present study aims to analyze the chemical, physical and biological risks at each control point and at each stage of the technological flow to identify, evaluate and eliminate any doubt that the finished product will be non-compliant or will not meet the safety standards and the quality to which it is subjected.

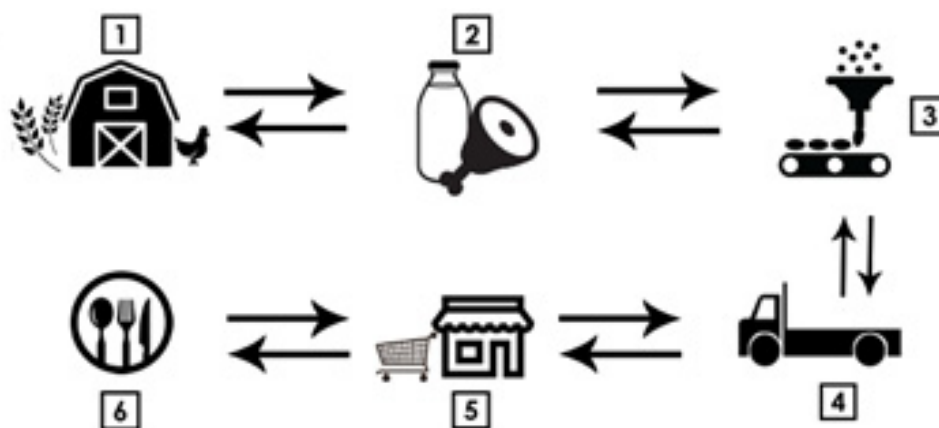


Fig. no. 1 Stages of the agri-food chain

Source: Self processing

As can be seen in figure 1, the food chain starts with the preproduction stage made in vegetal and animal farms, followed by the production phase, resulting in the primary food products such as milk, raw meat, eggs, bakery cereals, honey, etc. The third chain link illustrating traceability on the agro-food chain is represented by the processing stage that takes place either in slaughterhouses or in specialized processing units, resulting in

processed foods for consumption as such (slaughtered meat, products bakery) or products to be conditioned, packed and marketed (sausages, canned food, sweets). After the processing stage, another important chain link is represented by distribution that is followed in turn in specialized stores or supermarkets. The last stage is represented by consumption in which the processed or raw foods arrive at the final consumer included in the daily shopping cart

Table no. 1 Identifying the main categories of risks in the agri-food chain stages

CRITICAL CONTROL POINT	BIOLOGICAL RISKS	CHEMICAL RISKS	PHYSICAL RISKS
The Preproduction Stage	Pathogenic microorganisms: Trichinella, Salmonella, Leptospire, Koch Bacillus and non-pathogenic microorganisms - Coliform bacteria	Pesticides, Chemical fertilizers, Antibiotics, Veterinary medicines, Fertilizers, Herbicides	Glass from unprotected lighting fixtures, windows, insects, animal hair, nails, safety pins, accessories
Production Stage	Microorganism patogene: Trichinella, Salmonella, Bacillus Antracis, Brucella, Picorna virusuri, Tenia Saginata/Solium	Detergents, hygiene, additives, equipment lubricants, heavy metals, environmental pollutants	Plastics, accessories, employees, nails, hair, bones, glass, various impurities
Processing Stage	Penicillium, Aspergillus, Mucor, Cladosporium, Sporotrichum, Moraxella, Clostridium	Cleaning agents, coloring agents, detergents and disinfectants, sterilizing agents, polychlorinated phenols, equipment lubricants	Foreign bodies in the working environment, bones, hair, glass, plastics and metal, various impurities
Distribution Stage	Salmonella, Bacillus anthracis Bacillus Koch, Brucella, Leptospire, Ricketts Burnetti picornaviruses Trichinella, Tenia, Saginata / Solium, Different Molds Aspergillus genus	Various types of liquefied gases, cleaning agents, solvents, residues	Glass, stones, sand, insects, hair, plastics from damaged packaging or damaged utensils, dust

Source: *Self Processing according to Bălăucă Nicolae(2015) The main zoonoses in Romania incidence, evolution and legislative provisions, EuroAcademia, Bucharest*

To minimize the risks at each stage of the agri-food chain, the following prevention measures are proposed:

1. Compliance with hygiene rules throughout the technological flow
2. Apply corrective measures if critical limits are exceeded for each critical control point
3. Avoid direct contact of meat with contaminated surfaces or sources
4. Phytosanitary control periodically
5. Sanitary veterinary control before the animal is slaughtered
6. Sterilization of contact surfaces and textile materials
7. Permanent deparazitation
8. Prevention of the development of microorganisms in the class of molds on the surface of the meat

Results and Discussion

Following the research carried out on each stage of the agro-food chain, from farm to fork, aspects of particular importance are illustrated by respecting the technical parameters that are included in the present standards, the observance of the legal norms on food safety and environmental protection as well as the HACCP principles. The research results highlight the importance of prior identification of chemical, physical and biological risks at each stage of the industry and the establishment of both preventive and corrective measures. For a good functioning of the processing and production units, the decision maker will take the necessary measures depending on the situation, sometimes with huge losses.

The most important aspects to be taken into account in the optimal functioning of the agri-food units, regulated by the European Commission are:

1. Labeling - This will provide consumers with complete product information regarding the quality and chemical composition
2. Genetically modified organisms - Current legislation guarantees the absence of risk for the consumption of genetically modified foods but imposes the appropriate label
3. Plant and pesticide health - current legislation regulates the sustainable use of pesticides
4. Feed - Feed will, without exception, comply with the rules on food safety, hygiene, medication and additives

Conclusions

Over the years, a thorough study of food traceability has highlighted the great importance of risk analysis in every stage, from farm to fork - from pre-production to actual consumption. Due to globalization and the many factors that have led to it, food has become more and more processed lately, fact that influences the growth of the chain of nets on the food chain. Each of these links implies certain specific activities that correspond exactly to the quality and food safety standards ranging from the farm gate to the supermarket, activities that increase the risk of product contamination or non-observance of the technical-material parameters, which leads to the alteration or negative results in quality control from organoleptic and biochemical point of view.

An extensive and detailed analysis of the activities at each stage of the chain leads to the reduction of risks up to the minimum degree, which determines the fulfillment of the HACCP quality and food safety standards.

Risks of food contamination are divided into three categories depending on the contaminant and thus there may be biological risks when specific microorganisms, such as viruses, bacteria, fungi, etc. appear to be in check. , physical risks then canx food is contaminated with physical agents of nature (shards, sand, etc.) or chemical risks when chemical contaminants such as solvents, pesticides.

References

- Bălăucă, N., 2015. *The main zoonoses in Romania incidence, evolution and legislative provisions*. Bucharest: EuroAcademia.
- Bijman, J., Omta, S.W.F., Trienekens, J.H., 2006. *International Agri-food Chains and Networks. Management and Organization*. Wageningen: Academic Pub.
- Clark, C., 1960. *The economics of 1960*. London: Macmillian.
- Malassis, L., 1979. *Agro-food economy. Cujas*: Cujas Library.
- Oprea, A., 2011. *Control and Expertise of Foods of Animal Origin*. Bucharest.