

Food Safety Management System: Concept and Practical Implementation

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Abstract— In this paper the authors analyze modern food safety management systems and note that the emergence of the new danger generate a need for the modern concept's development of the security management system, which is based on an integrated approach, which provides the identification of all hazards posing risks and threats to human health and life. In the proposed concept of the food safety management system the basic component is a scientifically grounded systemic approach, which is based on HACCP principles, according to which safety is considered comprehensively as the absence of biological, chemical and physical substances, which are dangerous for humans. The modern concept also covers the nutrition factor and problems, which are related with falsification, the use of the new food technologies including the production of the food products by genetic engineering and nanotechnology, the use of the complex food additives and the introduction of the new types of the packaging materials. The analysis shows that these problems are typical for many countries, therefore, there isn't a need to develop only a national, but also within the framework of the economic integration entities, the concept of the food safety management system, initiated and coordinated by FAO / WHO. In this paper the authors note that the concept's implementation should provide for monitoring its implementation, as well as the social responsibility of business.

Keywords— *Food products, Security, Management systems, Concept, Food technologies, Falsification, Implementation.*

1. INTRODUCTION

In the international trade the food business estimates at \$ 1.7 trillion US dollars and takes the third place on financial significance [22]. At the same time this type of business is characterized by a specific type of the risk, which is associated with food safety, the absence or loss of which can lead to negative consequences for consumers, up to the death, and the destruction of the food company. Today the food risks associated with the loss of one of the fundamental properties of the product. Security is linked to international trade

inextricably, as evidenced by the facts systematized and published in the FAO / WHO research reports and other scientific publications. Examples of such incidents in recent years have included the finding of melamine in milk (China, 2008), the presence of lead that exceeds the maximum permissible concentration in pasta (India, 2015), turmeric powder and other spices (Asian countries, 2013 - 2017) and others [12, 18, 19]. According to the WHO, every year, as a result of the consumption of poor-quality food, every tenth person falls sick, and 420,000 die, the most at risk are children and people, who live in low-income areas [23, 15].

The problem of food safety is recognized by the world community. Now it is a priority in the development of many countries and the provision of safe food products is a priority for the government, business and consumers themselves. To solve the problem, various quality and safety management systems have been developed and implemented, at the same time, the emergence of new threats requires rethinking and the development of new criteria for assessing food safety, which determines the relevance of the chosen research direction. Many countries have already directed their efforts to modernize the implemented quality and safety management systems. This is caused by the population growth (projected to 2050 ten billion [25]) and such threats as urbanization, overcrowding, environmental pollution, abandonment of traditional food technologies and the transition to new ones, the development of the food additives industry and biologically active additives, the globalization of supply chains, etc.

Thereby, the purpose of the research is the results, which are reflected in this article, the development of the concept of the food safety management system, and proposals for its practical implementation.

Food safety is a state problem of assurance that food products under normal conditions of their use aren't harmful and don't present a danger to the health of the present and future generations [16]. In the theoretical aspect, it is based on

the study and systematization of normative documents and scientific publications, it is established that in the international practice, including Russia, various quality management and safety systems are used: the system GMP (Good Manufacture Practice), GHP (Good Hygiene Practice), HACCP (Hazard Analysis Critical Control Points), ISO 22 000 «Food safety management systems - requirements for any organization in food chain» and others.

Of course, each of these systems is an effective tool to ensure food safety, but, as a rule, the basic basis for ensuring the most complete food safety of all food production is a scientifically grounded systemic approach, which is based on the principles of HACCP. Deep and comprehensive risk analysis and identification of the critical control points at all technological stages of the food enterprise, monitoring and subsequent management, ensure the production of the safe food products are the essence of this system. The key concept of the HACCP system is the "food hazard", which refers to components in the food products or the state of food products, which have the potential to adversely affect health. HACCP is a concept, which provides the systematic identification, assessment and management of the hazards at all stages of the production and circulation of the products, which affect its safety significantly. This system is an effective means to protect against three types of hazards: microbiological, chemical and physical, it has proved to be an effective tool for identifying, preventing and eliminating problems that arise before inappropriate finished products become a source of poisoning or deterioration in consumer health.

Undoubtedly, microbiological decay, foodborne infections, contamination with contaminants and physical foreign substances remain important components and endanger the safety of the entire food chain. Unsafe food containing harmful bacteria, viruses, parasites or harmful chemicals that can cause more than 200 diseases ranging from diarrhea to cancers. 40% of the burden of the foodborne illnesses occur among children under five years, annually among them is 125 000 deaths [15].

At the same time, the analysis of the systems, including the HACCP system, shows that all aspects and realities aren't taken into account in existing systems.

The authors note that the situation is more aggravated due to unfair practices in particular falsification of the food [6]. Falsification is typical for almost all branches of the food industry and, perhaps, from the entire list of food products only edible eggs aren't subject of falsification, but in connection with the invention of artificial eggs in China, it is possible to assume a possible falsification in this segment. Information about the food's falsification isn't available only in the Russian Federation, but also it isn't available in all developed countries of the world, according to some sources [10, 17, 20]. It can be judged that falsification has acquired an international dimension. At the same time, Arnautov O. V. and others points out [1] that olive oil, wines and other alcoholic beverages, meat and dairy products, coffee, spices, fish, honey and other products are the most often falsified. The most incidents of the food products' falsification are

unnoticed, as their production, as a rule, it doesn't lead to a risk of reducing food safety and consumers often don't notice a decrease in their quality. Some of the results of the food products' falsification may pose a great danger to people's health. As a rule, these are types of the assortment and quality falsification that can lead to the use of the dangerous raw food and non-food ingredients and it can be real cause and potential risks to the consumers' health [1, 6, 9].

The authors' research is based on the example of the socially significant group of goods (meat and meat products), such as falsification, it is allowed to establish hazard and risks and assert that falsified products are potentially dangerous products and minimization of risks are associated with falsification in the system security management take a special place. Another aspect of food safety is the nutritional factor that should become necessary in the concept of a safety management system. Numerous research papers and books have shown that the use of unsafe foods correlates with impaired absorption and absorption of nutrients in the gastrointestinal tract. Many countries have already experienced problems with malnutrition, including malnutrition, obesity and overweight, as well as hidden hunger due to micronutrient deficiencies. WHO estimates that every third person in the world suffers from some forms of malnutrition [21]. There were so-called "diseases of civilization". They are alimentary diseases associated with malnutrition or excess nutrition: iron deficiency anemia; thyroid disease; rickets among children, osteoporosis among the elderly; diabetes mellitus, etc. [5]. At the same time, the problem of nutrition is a complex problem, which requires great knowledge and skills in various fields of the science and practice. The authors consider the nutritional factor in the context of the safety and from the point of the view of the food production, in particular, the supply of the food products to the producers. For example, the scarcest component of the majority of the food rations is a protein, primarily protein of the animal origin [4, 7, 24]. The world's protein deficiency and lack of it are likely to persist in the near future. For example, according to the Institute of Nutrition of the Russian Academy of Medical Sciences, the annual deficit of food protein exceeds 1 million tons in Russia. At present, symptoms of the pronounced protein-calorie deficiency and the risk of its development are revealed in 19% of the population and 40% of the population are deficient in protein [13]. Analysis of the food products produced by meat industry enterprises [3] shows that the products produced differ extremely low in protein content. If we consider the correlation of the ratio "protein: fat" to the requirements of the rational nutrition, there are significant deviations that lead to an increase in the fat intake, which once again underscores the lack of the groundlessness of the anxiety about protein deficiency among the population.

Particular attention in the world community is paid to the safety of genetically modified products. The statement that biotechnology, in particular the production of the food products by genetic engineering methods, as such methods isn't more dangerous, than, for example, traditional

technologies of the plant breeding is authoritative enough, as it follows from the efforts of more than 130 research projects covering 25 years studies and conducted with the participation of more than 500 independent research groups [14]. Perhaps an assessment of the safety of GMOs on the basis of the "Substantial Conformity" approach, comparative assessment of the resulting product with its analogue obtained by the traditional method, it will create an even more evidence base in favor of GMOs, we believe that the issue remains is open. The researchers emphasize, that the trends in the development of new biotechnologies [11] necessitate the systematic development of the new methodological approaches for monitoring GMOs. The nature of the production and provision of the population with the food products fundamentally changes the used food technologies. Applied new technological solutions instead of classical technologies allow giving the market new groups of the food products: functional, specialized, and combined with the given consumer properties, with long terms of storage and they promote increase in volumes of made production. In this paper the authors note that on the one hand, new technological schemes for the production of food products inherent in the simplification and reduction of production cycles for the sake of rapid profit-making and their incompleteness, but on the other hand, the complication of the technological process by the introduction of additional operations associated with processing raw materials and finished products, which undoubtedly affects both the diet and the quality and safety of the products. The consequences of the modern food technology over the past decades have become a matter of the concern throughout the world and this raises the need to provide the most rigorous assessments of the potential risks associated with their use.

The problem of the food safety is no less relevant, which is associated with the use of the food additives [21]. Food industry enterprises in all countries are active users of the food additives in the production. Nutritional supplements, as a rule, have no nutritional value, but nevertheless it is necessary to remember that these are the most massive xenobiotics from all substances that enter our body from the external environment and are extraneous to the body. In the best case, nutritional supplements are biologically inert to the human body, in the worst case, they aren't indifferent to humans. The adverse effects of the foods containing nutritional supplements may manifest as acute or chronic poisoning, as well as mutagenic, carcinogenic or other adverse long-term effects. The use of the unauthorized food additives or the use of the additives in doses exceeding the MPC, for example, sodium nitrite, food phosphates, synthetic dyes, preservatives and antioxidants, significantly increases the risk of the toxicity. Analysis of the food products shows that the use of the complex additives containing from 7 to 10 additives became natural, which, in our opinion, leads to an increase in the burden on the body of their effects. In addition, the likelihood of the excessive or untargeted use of the nutritional supplements increases, if the maximum allowed level of the consumption is exceeded; these substances can have various negative effects on the human

body. Considering that many types of the food additives can be manufactured using biotechnology methods using genetically modified objects, using nanotechnology, the threat of the hidden use of the genetically modified objects and food additives containing nanoparticles, for example, anti-caking agents, disintegrating agents, emulsifiers, stabilizers, clarifying, filtering materials, flocculants and sorbents, catalysts [2]. Therefore, there is a question of the correct use of the complex food additives and their regulation in the production of the food and consumption. The production and use of the food additives is associated with the need to monitor their content, which is not only in food products by controlling organizations, but also manufacturers of the food additives assess the content of the main substance and impurities in the products [8].

2. PRACTICAL IMPORTANCE

According to the authors, the current concept of the food safety management system should be based on the principles of HACCP. At the same time, the principles of HACCP can be applied to the development of the new products and the use of the new technologies, the control of the raw materials and ingredients, production processes, supply and other processes, if they relate to the field of the food safety. An analytical review of the scientific publications and official documents, statistical data and own research shows that these problems have acquired a global character. In this connection, there isn't a need to develop only a national economic, but also the framework of economic integration entities, the concept of the food safety management system, which initiated and coordinated by FAO / WHO.

The modern concept should include such components as preventing falsification, assessing the risks of the modern food technologies, including the production of the products, which is based on the methods of the genetically engineered engineering and nanotechnology, regulating the excessive or unauthorized use of the food additives, the ideology of the preserving and enhancing the nutritional value of the food and control of the pollutants, which appear with the introduction of the new packaging materials.

At the same time, the authors understand that existing food safety management systems without foreseeing falsification will not be able to counteract the production of the falsified products or the use of the potentially dangerous technology for the production or processing of the raw materials and food products. In this connection, the concept of the security management system should include monitoring as a fundamental function of management.

CONCLUSION

The entrepreneurial community must also realize that the specificity of the food industry lies in the fact that its expediency isn't determined only by economic indicators, but also by social significance, namely by the realization of the life support function of the population and, consequently, to

promote the realization of this concept and to bear social responsibility for the safety of the produced products.

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