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Food Safety in Foreign Trade of Agricultural and Food Products: Evaluation of Risk Analysis Stages and Process

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HIGHLIGHTS

- Food safety has become an important concept due to the structural characteristics of foods.
- The long duration of international trade adds importance to the food safety dimension.
- Risk analysis is an effective method to use in international trade.
- Risk communication is important for the effectiveness of risk assessment and risk management.

Abstract

Foods have become open to physical, chemical, and biological degradation due to their structural properties. The concept of food safety includes measures that can be taken against these types of may occur hazards and risks. Risk analysis is a planned approach created to identify risks to food safety and to reduce likely occur risks in terms of human health. The processes take a long time of storage, transportation, and distribution of products in international agriculture and food trade make them more vulnerable to physical, chemical, and biological risks. Food control systems applied in foreign trade of agricultural and food products are carried out based on risk analysis. In this study, the place and importance of risk analysis in foreign trade of agricultural and food products have been mentioned, and it has been tried to reveal the worldwide legislation regulations, practices, and development related to risk analysis.

Keywords: Codex; Food safety; International trade; Risk analysis processes; Standards

1. Introduction

Risk, the word origin, is coming from the French word "risque", if the Turkish Language Association Dictionary is meant the danger of exposure to harm (Turkish Language Association 2020). The word risk is been used in connection with food safety and health in recent years, one of the modern systems of food safety has been used risk analysis (Samimi and Samimi 2020). Risk analysis, on the other hand, means the process of estimating the probability and consequences of previously encountered and prioritized risks (Basset et al. 2019).

Foods, which are the basic life substances of humanity, are open to all kinds of risks due to their chemical, physical and biological properties. Food-borne risks have ensured that measures are taken by uncovering the concept of food safety. These risks are watched against biological and chemical hazards, to reduce the risks while political regulations involve direct measures, biosecurity regulations constitute indirect measures

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(Donohoe et al. 2018). Environmental events such as climate change, global warming, pollution of air and natural resources, water scarcity, natural disasters, population growth, obesity, and depletion of natural resources are also the main factors that endanger food security (Hanjra and Qureshi 2010).

Food security is defined as the physical, social, and economic accessibility of people to sufficient, safe, and nutritious food that meets their food preferences and nutritional needs for an active and healthy life (FAO 2019). Globalization and its expansion with it bring, to continue to observe that the concept of food safety in the food system poses a major risk, to reliable food supply important was made (Charlebois and Hielm 2014).

From the production stage of food to the consumption stage; in food legislation applications are based on risk analysis for reasons such as Protecting human health and ensuring food safety. Risk analysis should be, based on scientific evidence, independent, transparent and impartial (Turkey - Legal Gazette 2004). It covers the risk analysis practices in food safety, the probability of the risk that may occur due to the consumption of food and the determination of the effect on human health and the policies that will regulate the determination of these risks (Cebioglu and Onal 2018).

In the international literature, many studies have been conducted on the food safety applications of the risk analysis system. These studies; Examples of risk analysis in the applications of food codex (Demortain 2012), the importance of risk assessment in the development of international food standards (Karanusagar 2015), risk assessment for microbial and chemical hazards in food safety in the agricultural food chain (Jacxsens et al. 2016), risk communication in food safety (Aytekin 2015), the use of risk analysis and evaluation in the food safety control system (Godefroy et al. 2019) and the contribution of risk analysis to global food safety (Adamchick and Perez 2020) were realized on their subjects.

Although risk analysis practices are made a certain procedure by the WTO in international agriculture and food trade, these procedure implementations are dependent on the cultural and legal authority of the countries (Demortain, 2012). Compliance with standards and food safety requirements in international agriculture and food trade, the importance of applications increased (Malorgio et al. 2016). In this study, general lines of risk analysis and applied intended for applied to food safety in international agriculture and food trade were mentioned. The control mechanisms applied as risk analysis in food safety in foreign trade around the world have been emphasized, and solutions have been tried to propose to make them more effective.

2. Risk Analysis and Risk Analysis Processes in Food Safety

Risk analysis is not just for assessing the risks to agricultural practices and food businesses, it is an integrated approach that sees the food chain as a whole. For this purpose, a multidimensional approach is required in the economic, social, environmental, technical, and theoretical framework (Devos et al. 2019). In this context, risk analysis aims to protect consumers by controlling the raw material and production stages of food-borne hazards that will affect human health (Ozdemir and Topsumer 2017). In this way, risk analysis has formed the basis of food safety policy and was become the element that connects the food chain and food safety.

In developed countries, risk analysis contributes to improving public health by playing a major role in reducing foodborne diseases and understanding the risk of food (Roesel et al. 2015; FAO 2018). However, to reduce the risk that may occur in addition to the increasing costs of the measures taken, it is necessary to consider the economic losses that may occur in production and sales (Kunze 2016).

Foods are included for physical, chemical, and bio-logic sources risks in the process from production to consumption, especially chemical and biological hazards vary according to the structural characteristics of the food. With food safety and risk analysis, practices are minimized at every stage of the food chain diseases that may occur caused by food. Risk analysis, as well as human health and life, has been established to protect

animal and plant health and to ensure food and feed safety (Turkey - Legal Gazette 2010). Risk analysis can be an effective tool in food safety through the regulation of limited resources and quick decision-making by decision-makers (Safefood 2018). Yet, there is occurring speculation about the high cost of collecting and analyzing data related to food safety risk, the complexity of the link between contamination and harm, and the setting of standards established as a result (Lytton 2019).

Risk analysis is a process consisting of three main topics, which are risk assessment, risk management, and risk communication, with the framework drawn by the Codex Alimentarius Commission (CAC) (Figure 1). These components are scientifically based such as standards and criteria for food safety (Jacxsens et al. 2016). Thanks to these three frameworks that make up the risk analysis, it aims to increase food safety and minimize food-borne diseases by improving the food safety decision-making process with a realistic and scientific approach (Sampedro et al. 2016).

Figure 1. Relationship Between Risk Analysis Processes (Source: (FAO, 2021a))

3. Risk assessment

Risk assessment; consists of including hazard characterization, exposure assessment and risk characterization four scientific stages on independent and consecutive (FAO 2021a). Risk assessment stages are carried out by independent risk assessors working in organizations such as research institutes, universities, and research institutions. This stage is a scientific-based framework that requires multidisciplinary expertise, such as microbiological, chemical, public health, food production, processing technology, occurs in the form of present or absent (Karanusagar 2015; Edinger 2016).

The risk assessment process is realized qualitatively and quantitatively depending on the quality of the information and data obtained and the questions to be answered. The qualitative process consists of risk ranking, while the quantitative ranking consists of decisive or probability (Jacxsens et al. 2016). Since the results of risk assessment in food safety, it is based on risk management decisions and provided scientific information for risk communication, more effective use of resources is must essential (Wu et al. 2018). Besides the effective use of resources, should be included taking into account the consideration as well potential for human error in the risk assessment process (Walsh and Leva 2019).

If there is a risk occurrence condition as a result of risk assessment in the product put on the market, crisis management comes into play. Crisis management consists of communication, recall, destruction, and cost-benefit ratio stages (Szekacs et al. 2018). Risks may occur in food, in the risk assessment phase, each stakeholder making a separate assessment, stages of the supply chain is made difficult (Rathore et al. 2017).

In this study, general lines of risk analysis and applied intended for applied to food safety in International agriculture and food trade were mentioned. The control mechanisms applied as risk analysis in food safety in

foreign trade around the world have been emphasized, and solutions have been tried to propose to make them more effective.

4. Risk Management

Risk management consists of stages of problem identification, generating alternatives, developing policy tools (consulting, negotiating, and coordinating), decision-making, implementation, and evaluation of effectiveness (Aven 2016). It has been determined by "ISO 31000 Risk Management Principles and Guidelines" to create risk management to a certain standard. On the other hand, since the perception of risk differs from society to society, socio-cultural dimensions (sociological, cultural, and psychological) should be taken into account during the implementation phase of the standard (Aytekin 2015).

Since considering the risks that may arise during the risk management phase, CAC in food and agricultural products is based on risk management while setting international standards (Van der Meulen and Szajkowska 2012). In addition to setting international standards, legal risk management is aimed at protecting high levels of consumer health, harmonization national standards, and monitoring the (optimal) functioning of the internal market in the regulation of the European Food Safety Authority (EFSA) (OJ 2002).

For effective and accurate risk management businesses should do to follow the supply chain, which includes the production, processing, and distribution process, with traceability (Yaralı 2019). The agriculture and food industry must be sustainable to essential because they have a complex structure supply chain (Choirun et al. 2020). For this purpose, it is aimed to control the comprehensive and complex food supply chain by evaluating the danger with traceability and scientific data thanks to food safety management systems, especially HACCP (Hazard Analysis and Critical Control Point) (Walsh and Leva 2019). This means HACCP is an example of a new approach accepted by the CAC as a food safety practice, it is a systematic approach to the identification, assessment, and control of hazards (FAO/WHO 2005).

5. Risk Communication

Risk communication within the scope of food safety is defined as the exchange of information and views on risk-related factors and perceptions by risk evaluators and managers, consumers, industrialists, academic representatives, and other stakeholders in the risk analysis process (FAO 2021b). In short, risk communication helps communicate the complexity of the uncertainty of different levels in the risk assessment process of stakeholders. However, risk assessment experts can perceive the terms "hazard" and "risk" differently in risk communication, depending on the perspectives of the stakeholders (Barlow et al. 2015).

The quality and scope of the risk communication method have closely related to the use of effective tools, for means termination of the crisis and conveying correct information to the public (Aytekin 2015). Bridging consumers with scientific experts, policymakers, healthcare professionals and industry marketers for good risk communication in food safety help consumers accept and consider food-borne risks (Rutsaert et al. 2014).

Risk communication with consumers should be an effective implementation of risk management and their decisions on the exchange of information and ideas (Essumang 2018). Risk communication with this method, consumers who are unsure of their food safety, can have an impact on increasing trust by giving messages to social actors (Jonge et al. 2007).

6. Risk Analysis Applications on Foreign Trade of Agriculture and Food Products

The effects of food security are not limited to public health, also are affected agriculture, trade, and therefore international trade (INFOSAN 2015). The increase in international agriculture and food trade leads

to becoming global dangers and risks that will adversely affect public health. The increase in the volume of international agriculture and food trade has increased the importance of monitoring the dangers and risks that have become global (Messens et al. 2019).

In international agriculture and food trade, the analysis of border controls is not enough for food safety and food safety is ensured through a chain approach based on hazard and risk (King et al. 2017). Food safety legislation is divided that two hazard and risk-based, controls in international agriculture and food trade are carried out with a risk-based approach (Sampedro et al. 2016). It is provided a general assessment of risks with a risk-based approach in international trade and with the functioning of the food safety method, it is ensured that the standards are better determined (Hathaway 1999).

Risk analysis, depending on food safety, is responding to expected but unknown developments in the future and it laid the groundwork for promoting participation in global markets (Adamchick and Perez 2020). The application of risk analysis related to food safety was first brought to the agenda in 1983 by the National Academy of Sciences (NAS) in the USA the risk of cancer caused due to chemicals. In foods, assessing Risk analysis specific to agricultural and food products, came to the agenda after the food crisis experienced in the late 1990s. The European Union, with the white document published in January 2000, accepted as a principle to realize risk analysis in food safety. To handle food safety more centrally and comprehensively, EFSA was established in 2002, headquartered in Parma, Italy. The European Food Safety Authority (EFSA) was intended to create risk analysis by participating in all stages of food safety (EFSA 2020). The European Union, in this way, has provided to prevent the complexity of the control systems that member countries will implement separately.

Risk analysis within the scope of food safety in international trade was first started, after the establishment of WTO (World Trade Organization), in 1995 in the implementation and development of food standards focused on scientific-based risk assessment oriented. Subsequently, risk management and food safety began to be implemented in 1997, food standards and food safety with risk communication in 1998, and a risk assessment system for microbiological risks in 1999 (WHO 2008; Safefood 2018). In 2008, risk analysis became a global standard that established a framework for food security by CAC, which sets standards in international trade (Demortain 2012). International trade of agricultural and food products adopted risk analysis principles, it is also standardized procedures, besides simplifying transactions (WHO 2007). The impact of the food crisis experienced after the 1990s and the establishment of the WTO on international agriculture and food trade was observed after the 2000s, and this situation has further increased the importance of risk analysis practices (Figure 2).

The fact that retailers are responsible as well as producers in food safety, information sharing is important to supply to keep the spread of dangers under control in international agriculture and food trade has made risk communication an important process (Essumang 2018). In this context, a global network system was established in 2004 by the World Food Organization (FAO) and the World Health Organization (WHO) the name of the International Network of Food Safety Authorities (INFOSAN). This network consists of the national food safety authorities of over 190 member countries and its secretariat is run by WHO. The International Network of Food Safety Authorities (INFOSAN) is an important risk management tool that is effective in foodborne illness and disease prevention (FAO 2020).

To identify the risks that may arise from food, EFSA has created the Emerging Risk Exchange Network (EREN) system. In this system, EFSA is shaped to define the risk identification procedure as the definition of the priority problems, collecting data by determining data sources and evaluating the emerging risks (Donohoe et al. 2018). In addition, for biohazards, chemical deterioration, food consumption, and the risks that may occur as a result of consumption independently, transparently, confidentially, and clearly to

communicate somehow by monitoring information and data to develop a comprehensive risk assessment application with the scientific committee and panel experts were to aim (Ozbek and Fidan 2010; EFSA 2019).

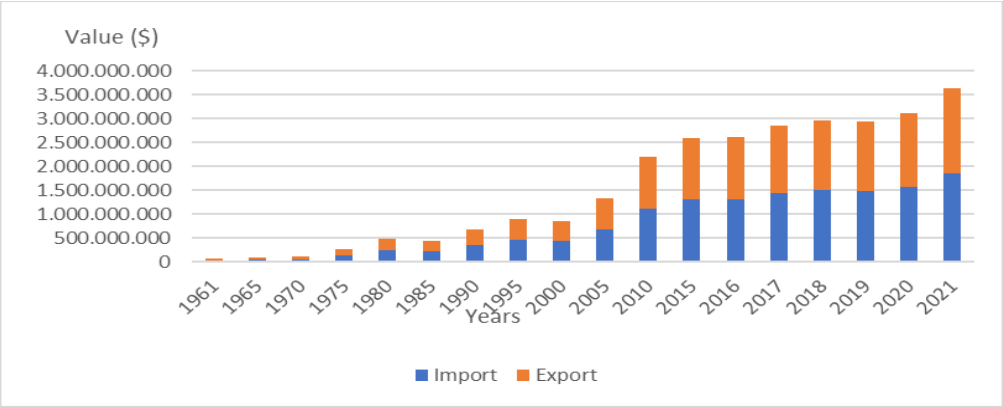

Figure 2. Development of international agriculture and food trade by years (Source: FAO)

In international trade, The World Food Organization (FAO) and WHO is included in the risk assessment process in terms of food safety (FAO 2018b). The Agreement on Sanitary and Phytosanitary (SPS), created with the establishment of the WTO in 1994, has formalized the practice of risk analysis in food safety; to protect the plant, animal, and human health, risk assessment, which is a component of risk analysis, has come to the fore. With the implementation of this component, the concept of the "Risk Assessment Paradigm" has emerged. Risk Assessment Paradigm, risk assessment and risk-related factors, the policies in the SPS Agreement aim to evaluate the measures that can be taken with commercial partners within the legal framework (Roberts 2012; Karanusagar 2015). This paradigm, as a result, risk analysis has ultimately led to not only covering scientific aspects but also such ethics, labor, and consumer choice (Smyth et al. 2015).

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The import security practices in the European Union in foods are accepted as the most strictly applied system worldwide compared to the codex (Malorgio et al. 2016). With the establishment of EFSA, the Rapid Alert System in Food and Feed (RASFF) system was developed, which had been established in 1979 to provide

risk analysis in food and feed imports. In the RASFF system, besides the European Union countries, in Non-EU countries such as Norway, Rapid Alarm System in Food and Feed (RASFF) system is an online system and applications of negative results are forwarded with feedback. In recent years, RASFF and INFOSAN have cooperated and all risks identified in the European Union are detailed and shared with INFOSAN, and encountered these risks are informed to INFOSAN members (Savelli et al. 2019).

Different approaches to risk analysis in food safety between Europe and the United States are reflected in their applications also in international trade. In the United States, the Operational and Administrative System for Import Support (OASIS) has been created under the leadership of the Food and Drug Administration (FDA) to reduce the risks in the import of agricultural and food products. The OASIS system measures the risk in imported agricultural and food products according to the product and country of origin, making risk assessments and reducing increasing concerns (Welburn et al. 2016; Yue 2016).

One of the five basic principles of the HACCP system, which became stronger with the SPS and TBT (Technical Barriers in Trade) agreements that came into force with the establishment of the World Trade Organization, is the risk analysis used for international trade agricultural and food (Ababouch et al. 2005). International trade agriculture and food (Ababouch et al. 2005). The HACCP system provides to codex based on food safety and quality with its wider application, especially in traditional inspection methods that are insufficient at the import stages (Al-Kandari and Jukes 2011). Risk analysis also contributes to fulfilling the obligations of SPS agreements, supporting the reliability of the food control system and detecting gaps in implementation (Godefroy et al. 2019).

There are criticisms that the SPS agreement in import transactions causes a loss of income and welfare by increasing production and trade costs during the implementation phase. However, under the SPS agreement, it can increase product demand by increasing product safety and quality by solving information problems about the product in terms of consumers. International standards created based on the scientific part of the SPS agreement, personal assessments to depend on consumer demand for food safety and the flow of international trade should also be considered (Yue 2016). In addition, the use of risk assessment tools in audits contributes to the fact that the standards are result-based rather than prescriptive (Cole and Martinez 2009).

7. Conclusions

It has become an increasingly important concept for reasons such as food security, growing population, a decrease in natural resources, and climate change risk analysis is accepted as an approach that promises to contribute to the development of food safety. Risk assessment, risk management, and risk communication that makes up the risk analysis are to enter on intertwined with each other in a process that aims to provide communication between scientific and political authorities about the risks that may occur in food. Since the risk assessment process is a scientific process and the information obtained forms the basis of risk management and risk communication, it should have a strong infrastructure.

The importance of risk analysis has increased due to the possibility of increased dangers and risks that may occur due to the long process from producer to consumer in international agriculture and food trade. The basis of risk analysis process practices in international agricultural and food trade was constituted by the establishment of the WTO in 1994. The standards and codexes applied with the SPS and TBT agreements created with the establishment of the WTO were created based on risk analysis. In the last period, some legislative regulations about risk analysis have been made, and these regulations should be made open to current changes.

Risk analysis applications in international trade create a certain cost, it makes it necessary to use risk analysis more effectively in international trade, especially in agricultural and food products imported from underdeveloped countries that do not have adequate surveillance and control mechanisms. Therefore, it has

contributed to the development and sustainability of risk analysis practices in international trade, thanks to the systems created in the main EU and the USA. In recent years, the continued work in the cooperation of application systems will contribute to minimizing the dangers and risks in international trade and will further increase the importance of risk analysis practices in food safety.

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