TRACEABILITY SYSTEM STRUCTURE DESIGN FOR FISH AND FISH PRODUCTS BASED ON SUPPLY CHAIN ACTORS NEEDS

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Abstract

This paper presents the structure design of a traceability system in fishery supply chain based on artificial intelligence and information technology for data acquisition and processing. The design activity takes into consideration the need of the Romanian fisheries to get an effective and practical quality safety monitoring tool for fish and fishery products. The traceability system development is based on the European and national legal framework, which was reviewed and on the all stakeholder's informational needs, which were identified by interviews with the stakeholders within the fish and fish products supply chain.

Key words: design, fish and fishery products, legal framework, stakeholders' needs, traceability system.

INTRODUCTION

The fishery supply chain is long and sinuous so the combinations of upstream and downstream components are difficult to be managed and traced. This is mainly due the fish industry includes different types of production and distribution chains, which make the tracing of the information to be very difficult.

In order to reduce the perceived risk associated with food consumption and to increase the consumers trust, countries from all over the world have introduced the Food Traceability System, which provides relevant information about the food supply chain, by introducing the concept from the farm to the table for fish and fish products as well (Choe et al., 2009). As a result, the inefficiency of the existing food safety systems together with the international developments linking food safety with trade, have determined the development of a new food legislation focused on assuring high levels of food safety (Van der Meulen, 2004).

Regarding the situation in Romania, there wasn't implemented an integrated traceability system for the fishery supply chain able to provide the complete and continuous monitoring of food safety and quality and the traceability at the national level.

On the other hand, there is a concern for complying with the EU legislation and also for development of a national legislation accordingly to EU legislation.

A traceability system is considered an effective tool to guarantee safety in fish products and improve the supply chain transparency (Nicolae et al., 2014).

Its purpose is appropriate when its development is based on the need of the fish supply stakeholders and, in the same time, in developed in the respect of the UE and national legal framework for food security and safety.

Rabade and Alfaro (2006) analyzed the influence of relationship between supplier and consumer on vegetable safety traceability, and then built an evaluation model on this basis. Resende-Filho (2007) analyzed the excitation mechanism of traceability system by building a supplier-consumer model.

An accurate achievement and implementation of a traceability system significantly reduces the risk exposure of the economic agents from the food chain by helping them to identify, isolate and correct any problem in an efficient and fast way. In this way food safety is guaranteed and the negative economic impact of this kind of incidents is minimised (Popa et al., 2010).

MATERIALS AND METHODS

The Informatic traceability systems are involved in all important data record keeping in the product evolution, in this case fish and fish products along the production and supplying chain.

The main components of the traceability system are the path identifying and information. The identification represents a process of recognition of the evolving elements in the production and distribution chain; information represents the process of sending information through different stages of the production and supplying chain. Each stage is described by different demands that need to be completely satisfied in order to build a strong and efficient traceability system.

The structure design of the information traceability system for fish and fish products is part of a research project that intends to realize this kind of a system. First of all, enforced national and EU food safety legislation has been revised and the demands that a traceability system must comply with have been identified.

A review of the literature (printed and/or available online) referring to identification of the main stakeholders of the supplying fish and fish product chain has been also researched. On the field, we have identified the elements and requests of the interested parties on traceability as well as their involving into the traceability chain for fish and fish products by interviews and questionnaires. All these elements are reflected in the design of the structure of the fish and fish products traceability system, so the interested one to be willing to implement and use it in order to improve food safety and economic performance.

RESULTS AND DISCUSSION

Fish and fish products traceability legal framework in the design of the traceability system structure

Drafting of the functional specifications of the traceability system as a stage of the establishment of an Informatic system for fish and fishery products has a starting point in the need to improve the selling activities and the degree of consumers need to be informed. This is in line with the measure proposed by the "Fishing and aquaculture Law" (2014) issued as a method to develop the aquaculture in Romania (Moga and Neculita, 2016b). Monitoring the information from fish and fish products distribution chain has been also considered when realising a specific adapted production system in Romania, as well as the complying to the EU and national legislative framework. In order to ensure the safety of the fishery supply chain, many countries, including Romania, issued food traceability policy for the adoption of the traceability system, which is becoming a helping tool for fishery stakeholders in order to manage the inputs and products and to improve food safety. Governments, particularly in developed countries, argue that existing food safety requirements have been ineffective in reducing the growing burden of food borne illnesses (Kelepouris et al., 2007).

Info storage eases the sending of the product history to control institutions as well as facilitate the access of consumers to these data via different access tools. This is in respect of the request issued by the National Sanitary Veterinary and Food Safety Authority (NSVFSA) in /order to assure food traceability based on the principle "one step back, one step forward" regulated by Regulation (EC) No 178/2002.

The projected system is offering the tools to help food operators to comply with suppliers and clients identification to find all the products from each supplier and also to have special info on the products sold to clients. By using the implemented processes, the system can fulfil the NSVFSA request to assure external and internal traceability.

The system helps the food operators to prove external traceability by using initial documents for raw materials, batches identification, delivery documents of finished products and batch marking in official documents. Regarding internal traceability, food operators need to have their own batching system, an internal batching chart and identification methods for precooked products and ingredients during processing, product batching and sampling. Registering of these traceability related information into the system can be available on request, on the spot (Moga and Neculita, 2016b).

The traceability system assures fish and fish products following by analysing the batch production numbers given to each move on the harvested products or processing at fisheries, production, processing units, warehouses and selling points. Thus, it is assured the implementing of the requests of the Regulation (EC) No 178/2002 which states the pathway of foods - known as distribution chain, that include the production steps to the final consumer (Moga and Cretu, 2016). Regulation (EC) No 178/2002 establishes the correct naming of production, processing and distribution stages as "any stage, primary production, storage, transportation, selling to the final consumer or to animal feeding". Furthermore, the system is following the Regulation (EC) No 1224/2009 which states that all fish products to be "batched before the first selling. In Romania, according to the Fishery and Aquaculture Law (2014), "products from commercial and aquaculture fishing placed on the market must be labelled consequently for each batch. All labelled data and the labelling procedure are regulated by the central public authority responsible for the fishery sector".

The stakeholders needs and the traceability system design
Different stakeholders have different requests and approaches towards the traceability based on their different role in the distribution chain for fish and fish products. Implementing and using the traceability system depends on the tight coordination between the parties involved in the distribution chain. When the traceability system meets all stakeholders needs (consumers and producers), the expected benefits are shown. For information data gathering, identifying of the main stakeholders of the fish product delivery chain, need to be done properly. These include: fish biologic material farms, fish rearing farms, production units, sales units and also consumers. Processing factories are in the centre of the supply chain, where the main capital, technology and human recourses are concentrated, compared to supplying and selling of fish products. At the processors stage, were also the main changes applied to raw materials.

The main Romanian stakeholders involved in fish and fish products traceability are:
- Producers - based on fish provenance - raw material:
    - for aquaculture products:
        • fish rearing farms;
        • recirculating aquaculture system.
    - commercial fishing:
        • wild fish: industrial fishing (natural interior ponds and Black Sea);
        • traditional fishing (natural interior ponds and Danube Delta).
- First selling points represent the link stage between the producer and processor/distributors;
- From producers or first selling points, fish and fish products are delivered to others (processor and/or distributors);
- The last representative in the commercial chain is the final consumer who needs to identify the information found in database of the product.
Regarding the Romanian business transaction system, these include engross markets, distributors, supermarkets, chains of supermarkets, direct buyers form local producers, small and independent shops and less known and used - electronic commerce. The consumers are the final stage in the supply chain. When the traceability system meets all participants - consumers and producers' requirements, then the anticipated benefits will be obtained. Therefore, a system of traceability intended for fishery products should harmonize the requirements of each of the categories presented (Moga and Neculita, 2016a).
The IT system for fish and fish products is made on a portal (platform) that allows inserting access to information on the entire distribution chain. The portal is structured in 3 access zones, based on the role in the system and intelligence needs of each involved stakeholder. The portal sections are presented in Figure 1: public area for consumers; private area 1 - for first selling points and processors; private area 2 - for portal administrator. Private areas 1 and 2 are available only to users that have allowance for access. For private access on the portal, users must have digital certificate or SSL, but also the authentication can be made using an ID and a password based on the email used for registration.

The structure of the traceability system is related to the starting point of the distribution chain of fish and fish products, represented based on provenance by the first selling points of the raw material, fish farmers or importers followed by processors, distributors e.a.
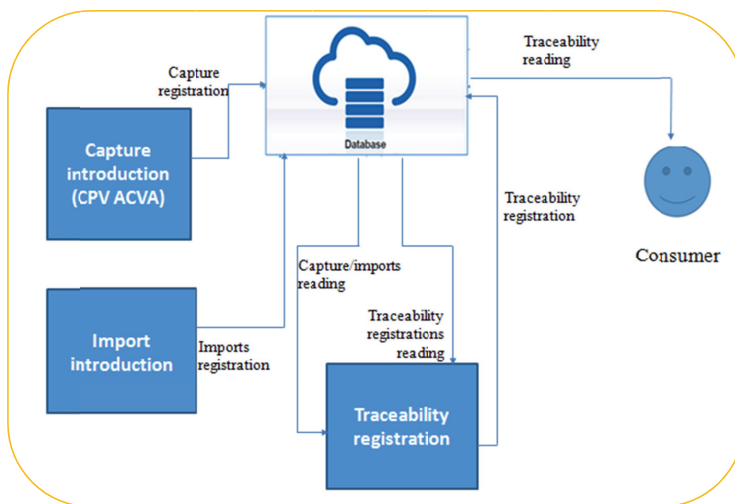

Figure 1. General scheme of the traceability system (original)

The information framework design in correlation with the stakeholders needs

In the traceability system, information is registered on the specific moments of the technological flow named as Reception, Harvesting, Acquisition, Processing and are from the informational point of view perceived as Batches or/and Re-batches.

When harvest the fish in their own ponds, the **fish farmers** have to batch the harvested fish and to mark the moment in the system (for every batch). They will introduce information related to harvesting date and hour, capture procedure, type of the pool form where the fish was harvested, its way of filling with water, treatments and selling procedures.

When receive the harvested fish from the fish farmers, **the first selling point** batches the products and mark the moment with the registration of harvesting date and hour, way of capture, hydrographical pool and the area of fishing and selling procedure.

Importers need to also batch the fish and fish products when receive it and mark the moment with register the information: import date, fishing date, FAO area, authorisation number of the producer, and ways of selling.

Distributors will identify the purchased fish batches based on the suppliers type and then re-batches and mention for each new batch the selling procedure. Processors are assimilated to distributors with the slight difference that when receiving the fish and fish products they can re-batch these products based on transforming after processing.

Consumers represent the essential component of this flow because the information received on different stages (by all the partners involved) is available and can be used to follow the traceability of the fish and fishery products. In this regard, the last distributor/processor (the one who is selling the fish) will have to give access to information on traceability by marking (when at weighing and labelling) with 2D bar codes. This procedure allows the reading of the primary information on the product and also analysing of the product path (by accessing the application TRASIPESC where all partners have been loaded information).

The traceability chain of fish and fish products can differs based on the status of actors involved. So, it can be short or long and it can change in time. If the fish and fish products are

intended for export or intra-community (EU countries) commerce, there is a need for labelling and certification.

For achieving competitive advantages there is the need to assume voluntary certification for fish and fish products of the importing countries (Nicolae et al., 2015).

CONCLUSIONS

1. Fish traceability can be perceived as a tool to provide a higher value of the product, by managing and controlling the processes, the stocks, and the products quality which conducts to an increasing of the consumers trust in food safety, growing of the operational efficiency for all the partners in the supply chain and ease a potential increasing of the profit for the companies from food industry.

2. Compliance to the legal framework for traceability in the European Union which is focused on the big importance of labeling of fish products and of the supporting documents serving as certificates, permits the achivement of all of the advantages provided by a traceability system.

3. As regarding Romania, although consumers are more aware, focused and interested in fish products safety, the implementation of a national integrated system that answers to the needs of safety and traceability is becoming more obvious and useful.

4. The traceability system designed for fish and fish products takes into consideration the requests imposed by the National Sanitary Veterinary and Food Safety Authority (NSVFSA) that state the importance of information sharing, organizing the traceability register of recorded database in order to be easily accessed "on request" with no delay. Although there is no obligation for economic agents for fish industry to adhere to an integrated system, considering the fact that such a system is in line with the NSVFSA requests, this could be a good reason for implementing / using the system by the fish industry.

5. For the food safety increasing, the responsible actors of the field must adopt and apply a responsible marketing policy that involves knowing of the path of foods from "from farm to fork".

6. The availability of the information regarding fish and fish products quality by marking the selling products (at weighing or labelling) represents an advantage for the economic agents but also for the consumers which are interested the traceability system for products.

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