General Architecture of Fresh Fruits Supply Chain Systems

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Abstract: - In the past 25 years the agri-food industry was the scene for some accidents or unpleasant events that generated very important changes in national and international regulations and standards that govern this domain. The consequences of changes determined companies to improve their traceability systems accordingly and to try to extend their business relationships for creating associations or alliances. This paper will present (a) an overview of the food safety and traceability most important issues, (b) a proposed architecture of fresh fruits supply chain systems. Conclusions and future directions of the research are discussed.

Key-Words: - Food safety, fresh fruits traceability, fresh fruits supply chain, information system

1 Introduction

The social and economic environment determined that the food safety and security issues to be one of top general concerns, therefore remain a high priority for most governments, private or public international organization, organizations from the extended food supply chain and final consumers.

Consequently, the cooperation between governments, producers, processors and distributors to build private or public bodies, having the main objective the building and continuously improving sets of standards that must be used for certifying agricultural products, was the next logical step. Antle (1999) consider that the goal of national and international regulations is *to ensure* and goal of national and international standards is *to certify* that the foodstuffs provided by companies from agri-food industry always fulfill the specified requirements regarding food safety and security.

The research objectives of this study are outlined below:

a) presenting an overview of food safety and food traceability;
b) proposing a general architecture of fresh fruits supply chain systems.

An extensive review of literature will be conducted in order to accomplish the objectives proposed for this study.

2 Food Safety and Traceability

The existing food safety policies have as a central point minimizing the concerning of final consumers related to food safety and maximizing the degree of achievements for requirements regarding foodstuffs quality, safe and security (Beulens et al., 2005; Wolfert et al., 2010). European Union consider it is necessary to be adopted an integrated approach related to food safety in order to be assured "*a high level of food safety, animal health, animal welfare and plant health within the European Union through coherent farm-to-table measures and adequate monitoring, while ensuring the effective functioning of the internal market*".

One of the most important issues in food safety is related to food traceability, therefore all national and international regulations and standards defines the concept of food traceability.

➢ ISO 22005:2007 defines traceability as "*the ability to follow the movement of a feed or food through specified stage(s) of production, processing and distribution*".
➢ GS1 defines traceability as "*the ability to track forward the movement through specified stage(s) of the extended supply chain and trace backward the history, application or location of that which is under consideration*".
➢ GLOBALG.A.P. defines traceability as "*the ability to retrace the history, use or location of a product (that is the origin of materials and parts, the history of processes applied to the product, or the distribution and placement of the product after delivery) by the means of recorded identification*".
➢ Codex Alimentarius Commission defines traceability as "*the ability to follow the*

movement of a food through specified stage(s) of production, processing and distribution”.

➢ Regulation (EC) No 178/2002 of the European Parliament and of the Council (in article 3) defines traceability as „*the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution*”.

➢ Law no. 150/2004 regarding food safety of the Romanian Parliament defines traceability as „*the ability to identify and trace through all stages, production, processing and distribution, of a food or animal feed, food-producing animal or any substance which will be incorporated in a foodstuff or animal feed*”.

Analyzing the food traceability definitions can be concluded that the perception about food (foodstuff) traceability expressed by the national or international organizations is relatively the same, some of definitions being more general other being more detailed, but all of them consider that food traceability ability that must follow the evolution of a food/foodstuff until its origin and even more.

Although consumers choose to buy certified food products mainly for health and safety reasons (Rosca, 2011), it is important to be mentioned that the implementation of a food safety standard does not guarantee that the problems related with food safety and security will disappear. For example, during the E.coli crises from 2011, some international organization involved in building food and safety standards were posted on their websites statements specifying that even an organization has implemented all procedures and assessments specified in standards the probability to appear situations that might generate to unsafe food for human consumption it is not totally eliminated. Of course, the chances to appear food safety and security issues in companies that respect procedures and assessments and have obtained certificates that confirm this fact are significant lower than the chances that exist in organizations that have not implemented these procedures and assessments.

3 General Architecture of Fresh Fruits Supply Chain Systems

In Figure 1 is presented a general architecture of fresh fruits supply chain system which is formed by the following: farms, farms suppliers, deposits, distributors, retailers and transports. The update of the national databases with information is realized by farms, deposits and distributors.
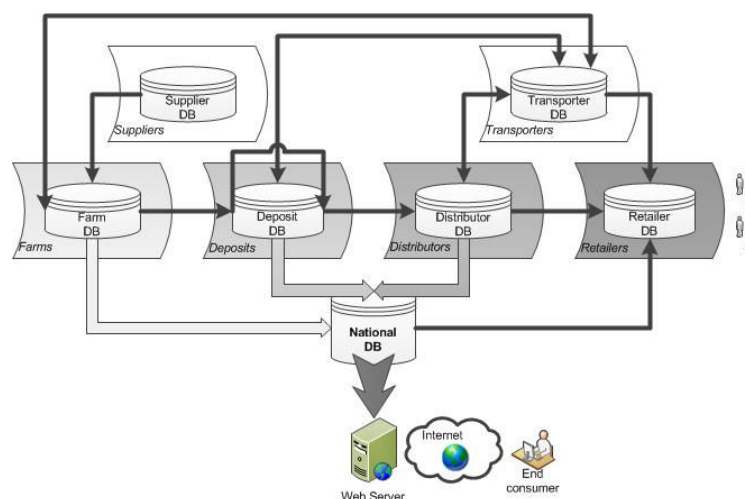

Figure 1 General Architecture of Fresh Fruits Supply Chain Systems

The relevant activities at each level from the fresh fruits supply chain are the following:

➢ At the farms level:

❖ The farm suppliers' databases send data to farm database with relevant data regarding the acquired resources: raw materials, chemicals, fertilizers etc.

❖ All the activities that affect soil by usage of chemicals, fertilizers etc. must be recorded in the farm's database and relevant data must be send it to national database.

❖ When farmers deliver goods to deposits, national databases is updated with relevant data related to these transactions from the farmer's database. In the same time, some data must to be send to transporter's database and after the transport is done,

farm's database must be updated from transporter's database.

- At the deposits level:
  - ❖ The databases belonging to deposits are updated with relevant data regarding the fresh fruits acquired from farmers' database and with other data regarding the transport from transporters' database.
  - ❖ When deposits deliver fresh fruits to distributors, national databases is updated with relevant data related to these transactions from the deposit's database.
  - ❖ When deposits deliver fresh fruits to distributors, national databases is updated with relevant data related to these transactions from the deposit's database. In the same time, some data must to be send to transporter's database and after the transport is done, deposit's database must be updated from transporter's database.
  - ❖ Sometimes it is possible that deposits to be hierarchically structured (local, regional and national deposits) and fresh fruits to be transferred from one deposit to another deposit. In this case, the procedure is similar with the existing procedure between deposits and distributors (national databases is updated with relevant data related to these transactions from the source deposit's database). In the same time, destination deposits are updated with relevant data regarding the fresh fruits transferred from source deposit's database and with other data regarding the transport from transporters' database.
- At the distributors level:
  - ❖ The databases belonging to distributors are updated with relevant data regarding the fresh fruits acquired from deposits' database.
  - ❖ When distributors deliver goods to retailers, national databases is updated with relevant data related to these transactions from the distributor's database.
  - ❖ The delivery of the fresh fruits from distributors to retailers can be made by a third part, in which case the distributors' database may be updated with relevant information related to the transport from the transporters' database.
- At the retailers level:
  - ❖ The databases belonging to retailers are updated with relevant data regarding the

fresh fruits acquired from distributors' database.
  - ❖ The delivery of the goods from distributors to retailers can be made by a third part, in which case the retailers' database may be updated with relevant information related to the transport from the transporters' database.
  - ❖ Retailers' database may access national database in order to present relevant information to the final consumer.

From security reasons, the national database is structured in two sections:

- *private section* – in which are stored all data received from farmers, deposits and distributors referring to transactions that involved fresh fruits;
- *public section* - in which are stored relevant data for the final consumer, and could be access by retailers (using an electronic data interchange protocol) or by final consumers (using a webpage). This section is updated periodically with data from private section.

One of the main objectives for fresh fruits traceability supply chain system is to provide and ensure the visibility for all process from supply chain. In order to achieve that objective, it is necessary that information system of every actors from fresh fruits supply chain to be inter-connected and connected to a national information system. This architecture can be assimilated with an inter-organizational information system (IOIS), that, according to Eom (2005) "*is an information and management system that transcends organizational boundaries via electronic linkages with its trading partners to share data, information, and business applications, provide the capabilities of electronic transactions including buying and selling goods and services, and facilitate communications and decision making for the purpose of increasing efficiency, effectiveness, competitiveness, and profitability for participating organizations*". The benefits of implementing an IOIS are represented by: (a) cost reductions; (b) productivity improvements; (c) product/market strategy (Barett and Konsynsky, 1982).

An important issue in the process of building IOIS is represented by modalities of data exchanges between involved actors using as much as possible the human interference and diminishing associated costs. The solution is to be used electronic data interchange (EDI) which is considered to be one of the primary enabling technologies for conducting e-business transactions and will remain, for a long period of time (Narayana et al., 2009), consequently will be the most

used technology for connecting information systems from an IOIS.

4 Conclusion

The total elimination of all risks related to food safety and security is impossible right now, but a significant reducing of potential risk that could affect fresh fruits safety and security and human health can be done by implementing procedures accordingly to existing national and international regulation and standards in the domain.

Moreover, the building and implementation of a fresh fruits supply chain information systems will two important results: (a) reducing the risks associated with fresh fruits safety and security and (b) increasing the final consumer trust in acquired product because the visibility offered by such a system.

The limitation of the research is given by the fact that in fresh fruits supply chain was included only the fruits that are produced by national farms, being ignored the fresh fruits imported.

Future research must take into consideration the influence of imported fresh fruits and to analyse the modalities for synchronizing and to assimilating significant and relevant data regarding imported goods in proposed system architecture.

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