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Abstract. It is widely accepted that Quality Management Systems approach is indicated to ensure quality of products and services. Furthermore, Total Quality Management, Six Sigma, ISO Standards and Hoshin Kanri have established as important management systems for quality guarantee in many production processes. Unfortunately, these systems are not familiar to agribusiness companies. The aim of this study is to analyze the benefits of application of traditional QMS in food supply chains. For the purpose of analysis, this paper investigates a case study in a Poultry Slaughterhouse company. The results showed that whether the company adopted the traditional QMS, it was able to solve the problem of temperature variation in the freezing tunnel in a short period an effective way. This article is part of a work to identify Supply Chain Quality Management applications in agribusiness companies.

Keywords: TQM; Six Sigma; ISO Standards; Hoshin Kanri; Agribusiness companies;

1 Introduction

A major current focus on agriculture and livestock supply chains is how to ensure quality and food safety. The importance of quality and food safety increases due to consumers' information about products and services. Supply Chain Quality Management (SCQM) has been considered an adequate approach to manage quality among organizations. Moreover, SCQM is a system for performance improvement that leverages opportunities created by suppliers and customers [1].

SCQM consists in the adoption of Quality Management Systems (QMS) along the whole supply chain. However, little attention has been provided to quality issues in supply chains [2]. In agribusiness, for example, researchers and firms are interested in achieving quality through the product characteristics and food safety [3], [4], [5], [6] and [7]. Therefore, it is difficult to find traditional quality management systems applied in food supply chains. This research identified that only a few authors reported applications of Total Quality Management (TQM), Six Sigma and ISO standards in food companies [8], [9] and [10].

TQM, Six Sigma, ISO standards and Hoshin Kanri (Police Deployment) have been studied for many years and they are used by different industrial companies. However, agriculture and livestock systems prefer to incorporate best practices, traceability, animal and crop control, government regulations and certifications to quality guarantee. Dora et al. argue that they did not find studies which integrate all concepts of quality like assurance, improvement, control, design and police in the food sector [4] and they established a Food Quality Management System (FQMS) to small and medium-size enterprises. Trienekens and Wognum studied the requirements of supply chain management in pork supply chains, which show the importance of quality for integrating supply chains and improve consumer confidence [11].

Although these approaches improve quality of food products, they avoid the adoption of traditional quality management systems. As a result, the chains can not be provided with knowledge and practice of these QMS.

This work examines a poultry productive chain and seeks to analyze the application of traditional QMS in problems resolution. With this aim the paper explores the production process in a Poultry Slaughterhouse. The hypothesis is that the adoption of QMS may solve the problem in an accurate way and allow company to ensure high levels of quality of products and food safety. In addition, this paper contributes to understanding of the small applicability of SCQM across food supply chains and agribusiness companies.

2 Quality Management Systems

2.1 Total Quality Management

There is a large volume of published studies describing the role of total quality management. These studies discuss and analyze the applications of TQM in industries and service operations with the purpose to show the advantages of this concept to ensure quality of products and services. TQM is applied in many organizations with the objective to improve product quality and increased customer satisfaction [12] and is divided into six elements: top management commitment; customer focus; supplier quality management; people management; continuous improvement; and process management [13].

TQM has its origin in Total Quality Control (TQC), and an administrative system improved in Japan from American ideas. Initially developed by Armand Feigenbaum, TQC practiced in Japan is different from that originally proposed

by Feigenbaum, because it is based on the participation of all sectors of the company and all the employees in studying and performing quality control.

2.2 Six Sigma

Six Sigma program is credited to Dr. Mike Harry, a statistician who was the principal founder of the Six Sigma Academy in Scottsdale, Arizona, United States. Motorola was the first U.S. company to adopt the system, followed by other organizations such as General Electric (GE) and Texas Instruments [14]. The idea behind the application consists of using statistical tools to reduce process variability.

The objective of the Six Sigma approach consists of search zero defect condition of services and products. However the goal is to reach 3.4 defects per million of opportunities and it uses a structure method named DMAIC (Define, Measure, Analyze, Improve and Control) [15].

2.3 ISO 9001 Standards

The ISO 9001 series is a designation given to quality management systems standards emerged in 1987 and became a worldwide phenomenon showing tremendous growth and dissemination across different countries [16]. In 2010, ISO 9001 was implemented in 1.109.905 companies in 178 countries [17]. ISO standards represent an international consensus on good management practices with the purpose of ensuring the supply of products that meet customer requirements and with a focus in continuous improvement [18]. Moreover, the ISO 9001 standard allows certification by assessed companies, which meets its requeriments.

2.4 Hoshin Kanri (Policy Deployment)

Policy deployment, known in Japan as Hoshin Kanri, is an administrative system for strategic management [19]. It was originally developed in Japanese industries as alternative to the concept of management by objectives [20]. To implement Hoshin Kanri, companies need (1) to provide a focus on corporate direction by setting, annually, a few strategic priorities; (2) to align the strategic priorities with local plans and programs; (3) to integrate the strategic priorities with daily management; (4) provide a structured review of the progress of the strategic priorities [19] and [20].

3 Methodology

This research was conducted in a company of food processing code PS (Poultry Slaughterhouse). The company was selected in Mato Grosso do Sul State, which is located in the center-western of Brazil. This region concentrates 10.6% of poultry production in the country [21].

The company was well characterized in the poultry respective supply chain and informations were collected from company, downstream and upstream partners. The company was evaluated with the purpose of identifying traditional QMS practices. Using traditional quality management approaches, a production process was chosen to check the advantages of implementing a QMS. After, TQM, Six Sigma, ISO standards and Hoshin Kanri were correlated with this process, emphasizing possible results of its application.

This method allows food companies to understand the importance of traditional QMS in operations management. Similarly, it enables firms to simulate the adoption of QMS providing a way of evaluating the system efficiency. A case study approach is used to permit an analysis in a real situation.

It is recognized that sample is quite small to characterize the application of the QMS in the food supply chains and unavoidable future work will be necessary. However, as the research is a case of study, this small sample does not invalidate the work results.

4 Case Study

The company operates in the frozen meat market (poultry and pork) and processing meat foods, dairy margarine, pasta, pizza and frozen vegetables. It is present in all regions of Brazil with 49 plants and its products reach consumers in 98% of Brazilian territory. Its international market involves more than 110 countries on the five continents. The company net sales in 2013 was 9,957 million Euros, where 56% in domestic market and 44% in international market. It is responsible for 20% of world trade in poultry [22].

In this study, a plant located in Brazil center-western was analyzed. It process 170 thousand poultry per day and animals are supplied by different farm producers in the region, that follow procedures established by PS. A simplified supply chain can be seen in Figure 1.

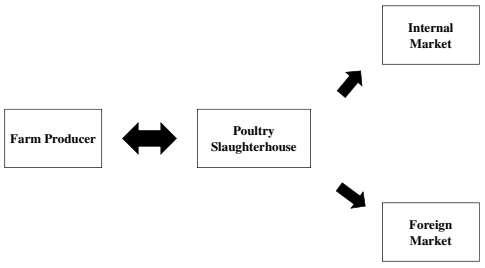

Fig. 1. Poultry Slaughterhouse supply chain

Figure 1 illustrates the main steps in this chain. Farm producers receive feed and pullets from PS and other sources. Then, the farm producers, after finishing process, send Poultry to PS where the company transforms these animals in fresh meat and industrialized products. Afterwards, these products are shipped to internal and international markets.

The company is responsible for ensuring product quality from the source to the consumer market. In the production process the quality of products is guaranteed by practices applied by company and by the Federal Inspection Service (SIF, in Portuguese language). SIF is a control system within the Ministry of Agriculture and Livestock that aims to assure quality and food security through meat origin and physical characteristics.

However, in this study, the purpose is to establish an example of the importance of application of the traditional QMS in this organization. Thus, the problem of the variability of temperature in freezing process was analyzed. To understand more clearly the problem, it is important known steps of the production process that can be seen in Figure 2.

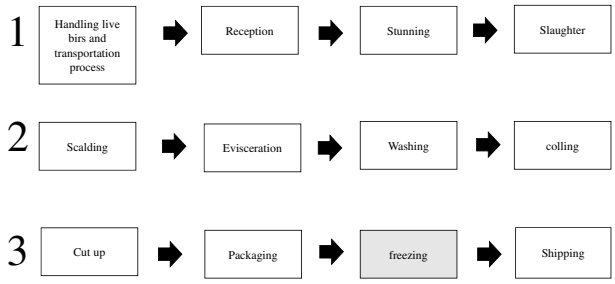

Fig. 2. Poultry slaughterhouse production process

The frozen meat is produced in a freezing tunnel (ACT. Automatic Control Tunnel), which works at temperatures between $-40\,^{\circ}\mathrm{C}$ and $35\,^{\circ}\mathrm{C}$ (Celsius degree). Products for the domestic market are shipped when the temperature reach $-12\,^{\circ}\mathrm{C}$, and the foreign market, only after $-18\,^{\circ}\mathrm{C}$. As operation of the freezing tunnel is automatic, company shell respect a standard time so that the products reaches the ideal temperature. Figure 3 shows na illustrative picture of a freezing tunnel.

The company's tunnel begun to change the temperature and time for freezing products, increasing the variability of the process. For some years, the company

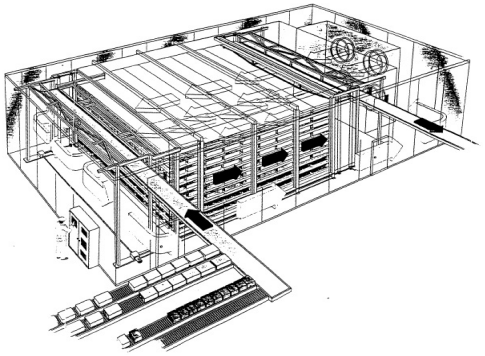

Fig. 3. ACT. Source: [23]

bored the problem, but the rise of demand forced it to try solve the problem. Now they are studying, an expansion of the plant and analyzing the possibility of change the ACT.

Our hypotheses are that, if the company had adopted a traditional QMS in the production process, they would be able to solve this issue many time before. Bellow are presented some ideas about the relationship of traditional QMS and the problem discussed.

TQM: Tools of TQM as control charts, Ishikawa's diagram and circles of quality, allowing to identify problems in a specific matter and possible corrective actions. Using TQM, PS could be able of finding out the variations in the process caused by ACT and applying solutions based on TQM tools. Moreover, tools like PDCA cycle (Plan, Do, Check and Act) should permit the company to make a continuing evaluation of its production process and consequently find answers and solutions to quality issues.

Six Sigma: Is a quality management system that aims to solve quality problems through the elimination of variation. In this specific case, the ACT presented variations in freezing temperature in comparison to the correct pattern. This variation between pattern time and real time might have been identified by quality control members of Six Sigma Belts and the corrective actions would be taken to resolve the issue.

ISO 9001 Standard: Represents a quality management system that aims to standardize process, ensuring quality of products and production processes. In this case, the variation of the ACT modifies the parameters of tunnel operation and generate ISO non-conformance, that needs to be solved by the company. Consequently the obligation of company in solving the non-conformance would permit the resolution of this problem.

Hoshing Kanri: Is a business management that can guarantee quality, because influences in the guidelines and goals set by management. Thus, these guidelines established for the production are directly related to process efficiency. So, failures in the ACT would need to be solved to ensure service guidelines and hence the quality of process and products.

5 Conclusion

The agribusiness enterprises have assured the quality of its products through sensory analysis made by consumers. Thus, the processes and activities are designed and crafted to ensure characteristics of the products to attend consumers' requirements. However, the control of the quality and food safety through physical characteristics of products does not indicate that the processes and products are controlled by quality management practices. QMS can increase the process efficiency and guarantee quality and food safety.

The case study showed that Poultry Slaughterhouse does not adopt traditional QMS. It seeks to assure quality of its products by having a SIF certificate. This certification is an obligation for the animal products in Brazil. However, this certificate was not enough to correct na ACT problem, as a consequence of the temperature variation, effect on the meat quality. If the company had implemented a traditional QMS, it would be able to solve the variation in ACT, thus ensuring quality of products and efficiency of process.

The analysis performed in this article shows that the hypotheses of adoption of QMS should solve the problems in PS in an proper way and ensure high levels of quality products and food safety is true.

One of the limitations of this paper is that only one case was be presented, which avoid the feasibility of establish a generalization of this study. So, the next steps of this research is to analyze other companies to validate the hypotheses presented.

The research about the quality in agribusiness is still in progress and is expected to interact with producers, researchers and industries in order to better understand this gap and find out solutions to guarantee improved quality of products in agribusiness companies.

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