

AN OVERVIEW OF INTEGRATED MODELS FOR QUALITY MANAGEMENT IN THE AGRI-FOOD INDUSTRY THROUGH COST/BENEFIT ANALYSIS

A Case of the Variety of Quality Systems in the Agri-Food Industry in Europe

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Abstrak

Konsep manajemen mutu telah dimulai sejak tahun 50-an. Saat ini banyak sistem manajemen mutu berbeda yang telah dikembangkan. Ketidacukupan dalam keamanan pangan dan globalisasi merupakan alasan dalam pengembangan sistem mutu dalam bidang agribisnis dan industri pangan. Kadangkala ada beberapa sistem mutu yang relevan untuk perusahaan. Namun demikian, lebih efisien bagi perusahaan untuk menganalisis persyaratan sistem manajemen mutu yang berbeda yang bertujuan untuk mengurangi double persyaratan. Hasilnya adalah sistem manajemen mutu yang terintegrasi.

Kata kunci: manajemen mutu, keamanan pangan, globalisasi

1. INTRODUCTION

Quality management is a vital importance in all stages of the agri-food production and process chain. The approach of quality management has been changed in past years due to the effects of globalisation, several shortages in food safety and the legislative such as new European regulation 178/2002 concerning food safety.

There are general quality systems that are applied in different countries and sectors, country and product specific systems, which were developed by retail initiatives. The formulation of production processes and documentation is a central dimension of these different quality systems. Typically, most of their requirements are not harmonized and an acceptance often does not exist between different quality systems. Nevertheless, in some cases the requirements of different quality systems are nearly the same. The result is that industries who have implemented different quality systems have to fulfil a lot of requirements for their certification. Therefore, without an integrated completion much double work would be done.

Due to the variety of different quality systems, industries select quality management systems by comparing the requirements against the benefits. Thus, the question arises for industries how important quality management systems are and which advantages/disadvantages do they get with or without certification.

2. CHANGES IN THE FOOD SAFETY LEGISLATION

Food legislation has changed during the past years. For instance, in 1990 the product liability

law was published. A key element of this law is that the producers have to fulfil the due diligence of the product, it means that industries have to take all relevant steps to assure the safety of the products. In 2000 the law redefined the legal meaning of due diligence (Krieger, 2002).

Another development was the publishing of the white book in 2000 by the EU. The new EU regulation 178/2002 with paragraph 18 concerning traceability of food is one result of the 84 actions of the white book (Krieger, 2004a).

The regulation 852/2004 aims to harmonize food hygienic legislation across Europe. This legislation lays down general requirements relating to food hygiene, clarifying the existing responsibilities of food business and is effective from January 2006. In a true 'farm to fork' approach, primary producers are now subject to the hygiene requirements (Krieger, 2004a).

This legislation and changes of their requirements are also reasons for the development of quality systems.

3. HISTORY OF QUALITY MANAGEMENT SYSTEMS

An important development is that corresponding to the principles established in the Codex Alimentarius food safety management systems based on Hazard Analysis Critical Control Point (HACCP) principles will be mandatory for all food businesses.

During 1960's, FAO and WHO developed the Codex Alimentarius regulation due to the expansion of the food trade. Furthermore, until now this regulation has influences on quality and safety in the global food supply chain and is a basis for a 'fair' international trade. In the 80's the development of systems with regard to

process management ('Good practice') started. Good practice (particularly the good agricultural (GAP), good hygienic (GHP), good manufacturing (GMP) and good trade practice (GTP)) is a basis for a quality management. GAP is a guideline for the reduction of chemical, physical and biological hazards. GHP is obligatory for preventive hygienic arrangements in the industry and GMP is a basis for ensuring that products are consistently produced and controlled according to quality standards. GTP is a guideline for adequate transport of animals, raw materials and food (Krieger, 2002).

Since the 90's, the international norm ISO 9000 has become popular. ISO (International Organisation for Standardisation) norms are international standards in order to achieve uniformity and to prevent technical barriers to trade throughout the world. The reason for the development of ISO 9000 was the publication of a consistent norm, which formulates the framework for quality management (Pfeifer, 2001).

Since the middle of 90's, more and more systems with reference to the HACCP system are implemented in the agri-food sector.

The main point of the HACCP concept is the identification of health hazards during the production. It includes seven HACCP principles. Conduct hazard analysis and identify control measures, identify critical control points (CCP), establish critical limits, monitor each CCP, establish corrective action to be taken when a critical limit deviation occurs, establish verification procedures and establish a record-keeping system (Luning et al., 2002).

Corresponding to the increase of different national certification standards for HACCP such as DS 3027 in Denmark, an HACCP standard in

the Netherlands, the international standard ISO 22000 is directed for the standardization of these different systems. The system's main point is the control of hazards with specific measures (SSM). The definition of SSM is supportive safety measures, specified activities, other than critical control points that affect food safety by preventing, eliminating or reducing the probability of hazard occurrence (Bureau Veritas, 2002).

Furthermore, quality systems have been developed with specific demands for the agri-food industry and with a view on supply chains. For example, quality management milk in Germany and the integrated chain control system (IKB) of the Netherlands are vertical oriented quality system, while International Food Standard (IFS), the British Retail Consortium (BRC), the European Food Safety Inspection Service (EFSIS), which were developed by retailers, the ISO 9000 standard and HACCP are horizontal quality system (Krieger, 2004a).

4. COSTS AND BENEFITS OF QUALITY MANAGEMENT SYSTEMS

4.1 Costs of Quality Systems

To measure the effectiveness of quality management systems, cost and benefits are important aspects. Krieger (2004a) conducted a study about internal cost of a quality system in industries. They sent out questionnaires to the 300 biggest companies of the German food industry. The result showed that documentation and the high cost of entry checking and process analysis got the most criticism by the industries as shown in Figure 1. Fault analysis cause 14%, quality checking 11% and training 10% of quality costs in the industries.

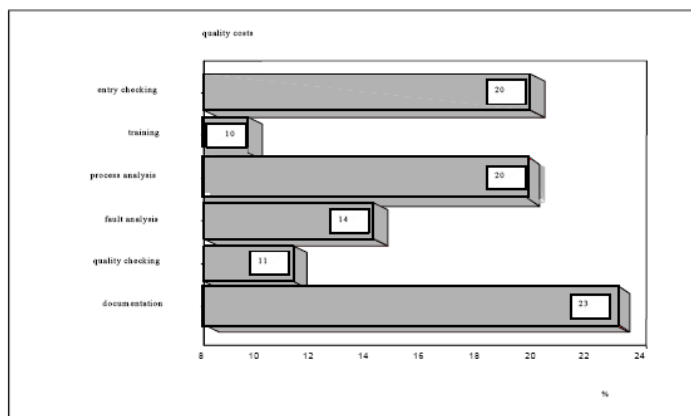


Figure 1 Internal Costs of Quality System in the Industries (Krieger, 2004a)

4.2 Background of Benefit Dimensions

Benefits of quality management have very different dimensions. However, there are some benefit aspects which are more important and actual than others to evaluate the quality concepts, as follows:

1. Market entry

In some cases, a quality system certification is an entry to markets. The reason is that without certification it is not possible to sell on this market. Standards can also be a barrier to trade for poorer developing countries because the cost of meeting them is assumed prohibitively high.

2. Product liability

Since 2000, product liability has been a catchword not only in the food and agri industry. A key example is the legal standard to meet due diligence requirements of the product liability law. The requirements that industries practice due diligence simply means that the industry have to take all important steps to assure the safety of the products.

3. Cross compliance

In some cases the demands of the regulations have intersections with the demands of quality management systems. For example, the farmers can get the subsidy payment if they can fulfil the 19 EU-regulations.

4. Process quality

Process quality is the organization of the internal process and the transactions between industries. An optimal organization of a process means lower costs. Furthermore, the requirements of different quality systems have a special focus on the optimal organization of the processes in the industries.

5. Product quality

Product quality concerns on the one hand physical product attributes (taste, shelf life, etc) and on the other hand the safety of a product with regard to health aspects.

6. Traceability

The EU regulation 178/2002 contains general provisions for traceability, which cover all food and feed business operators, without prejudice to existing legislation on specific sectors such as beef, fish, GMOs (Krieger, 2004a). Importers are similarly affected, as they will be required to identify from whom the product was exported in

the country of origin. Traceability has to be done one step back and one step forward.

The evaluation of quality concepts is based in this paper on the six above mentioned benefit dimensions.

In the 80's, the HACCP concept became popular in the USA and later on in Europe. HACCP is widely recognized in the food industry as an effective approach to establishing good production, sanitation and manufacturing practices that produce safe foods (Pierson & Corlett, 1992). It establishes process control through identifying points in the production process that are most critical to monitor and control. HACCP's preventive focus is seen as more cost effective than testing a product and the destroying or reworking it. The system can be applied to control any stage in the food system, and is designed to provide enough feedback to direct corrective activities. Figure 2 shows the main focus of HACCP is product quality of food. Unnevehr and Jensen (1998) stated that food borne illness has been decreased since the integration of HACCP. However, product quality can only be guaranteed if the process organization is in a good order.

Caswell and Hooker (1996) found that adoption of HACCP as a regulatory standard has been motivated first by food safety concerns, and only second by a desire to facilitate trade. However, the process of facilitating trade required mutual recognition of HACCP regulations across national boundaries, which shows that HACCP is internationally necessary for the market entry (Unnevehr & Jensen, 1998).

Regarding to greater food industry concentration, HACCP regulation may also create incentives for greater vertical coordination to control food safety throughout the production process. Mazzocco (1996) stated that there is no necessary control if the product deliver and it is less expensive to contract or control production processes upstream. A better vertical coordination can be guaranteed.

Another benefit is seen in product liability. HACCP formulates no special requirements which do fulfil Cross Compliance requests as shown in Figure 2.

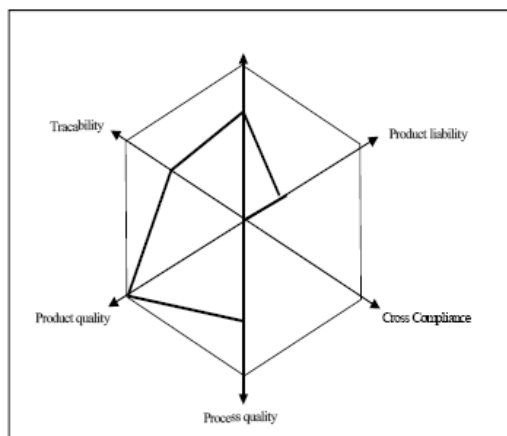


Figure 2 Benefits of HACCP (Krieger, 2004a)

In the nineties the ISO 9000 standard was developed. ISO 9000 is a set of international voluntary quality management standards that ensure a consistent production process. The result is an improving in the efficiency (Bocker et al., 2004). The ISO 9000 is a framework for a quality management system and the integration in the industry is very flexible. Thus, the accomplishment of the ISO 9000 is not a guarantee of good product quality.

This standard has an international acceptance and it was relevant for the market

entry. A survey conducted by Capmany et al. (2000) found that international marketing aspects of the ISO 9000 certification and access to other markets have been regarded as one of the most important reasons to seek certification. A vertical traceability is not the main focus of the ISO 9000 like the product liability. The ISO 9000 has also no special requirements that are important to fulfil Cross Compliance demands. Nevertheless, it is possible to create the ISO 9000 on the farm with focus on their fulfilment as shown in Figure 3.

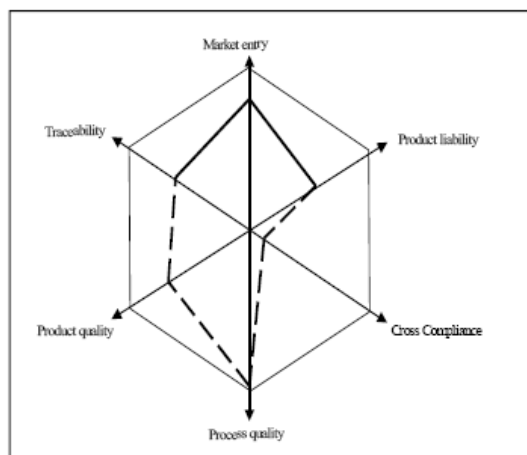


Figure 3 Benefits of ISO (Krieger, 2004a)

Retailer initiatives developed quality systems for the food industry in the past years. on the one side there are quality systems like the International Food Standard (IFS), the British Retail Consortium (BRC) and the European Food Safety Inspection Service (EFSIS) for the supplier to the retail and on the other hand, there is EurepGAP, a system for the farmers (Krieger, 2004b). Retailers ask for this system also due to

product liability. Interventions exist between the requirements of the EurepGAP System and Cross Compliance.

The requirements of horizontal quality systems are mainly recording process quality (Krieger, 2002). Product quality is also in focus of these quality systems. An interaction between different quality systems over the stages of the agri-food supply chain would raise traceability.

For instance a combination of EurepGAP for farmers and of IFS for the supplier could increase a higher tracking and tracing between the stages of the agri-food industry (Figure 4).

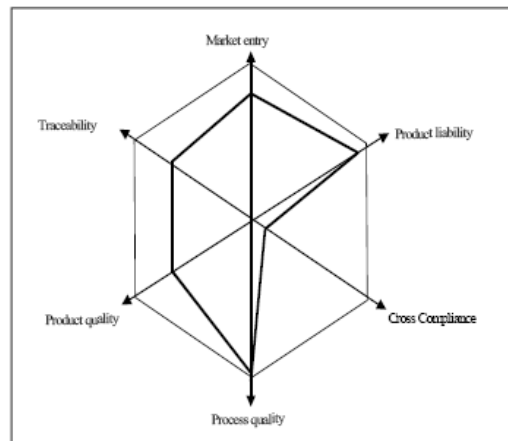


Figure 4 Benefits of Horizontally Oriented Quality System

The main focus of vertical oriented quality systems is traceability. The intensity of the cooperation between the different stages of the supply chain can be different. The supply chain can have an open character, a semi closed character and a closed character. The result is that cooperation and traceability have a different intensity. Vertically oriented quality systems have problems to be accepted by the retail, because the retail stage has designed their “own” quality systems. The result was that only a few retailers

ask for vertical oriented quality system because they also have to fulfil special demands. Product liability plays also a rule like Cross Compliance.

Furthermore, Schiefer (2004) explained that process quality is characterized by management routines that support the organization and control of processes to assure desired process output. Points with this focus are also implemented in vertically oriented quality systems but more important is the preservation of product quality and safety as shown in Figure 5.

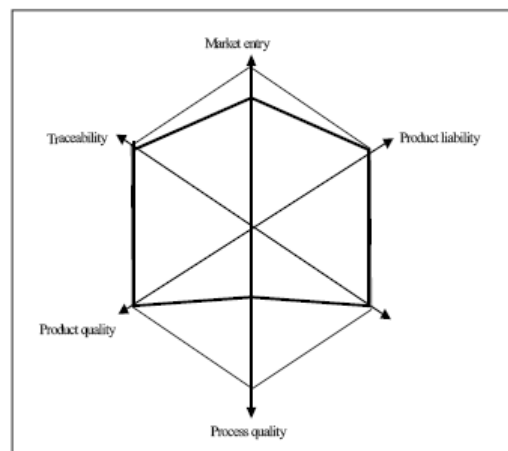


Figure 5 Benefits of Vertically Oriented Quality Systems

Benefits can be shown if the industry does an integrated quality system. Advantages of an integrated quality system are the use of synergies, reduction of time and cost in the application of quality systems and an easier

integration of new quality systems (Unnevehr and Jensen, 1998).

5. COST VALUE ANALYSIS

Cost value analysis about special quality management scenarios in companies is an important step. Marginal cost is the additional cost from increasing an activity. In production, marginal cost is the additional cost of producing one more unit of output (Luning, et al., 2002).

The firm's optimization calculus can be represented as follows the firm's marginal cost (MC) arise from the marginal costs of the fulfilment of the demands of the new quality system (MC_N) minus the marginal costs of the existence quality system (MC_E) and the requirements which are not requirements of the new quality system. Another relevant parameter for the integration of a quality management system is the certification costs (MC_C).

$$(1) \quad MC = MC_N - (MC_E - MC_{EA}) + MC_C$$

Where MC = marginal costs

MC_E = requirements of existence quality systems

MC_N = requirements of new quality systems

MC_{EA} = requirements of existence quality system but not of the new one

MC_C = costs for certification

The marginal benefit (MB) of a new quality system is the marginal sum of the advantages which arise from an implementation for a company like a market entry (MB_M), more product liability (MB_P), fulfil of demands for Cross Compliance (MB_C), improving in the process quality (MB_{PQ}), better product quality (MB_{PR}), enhance changes in the traceability (MB_T), and special benefits for a company (MB_F).

$$(2) \quad MB = MB_M + MB_P + MB_C + MB_{PQ} + MB_{PR} + MB_T + MB_F$$

Where MB = marginal benefit

MB_M = benefits for market entry

MB_P = benefits for product liability

MB_C = benefits for Cross Compliance

MB_{PQ} = benefits for process quality

MB_{PR} = benefits for product quality

MB_T = benefits for traceability

MB_F = benefits for firms

From this situation an optimal combination of quality systems (q_{opt} / C_{opt}) can be developed as seen in Figure 6.

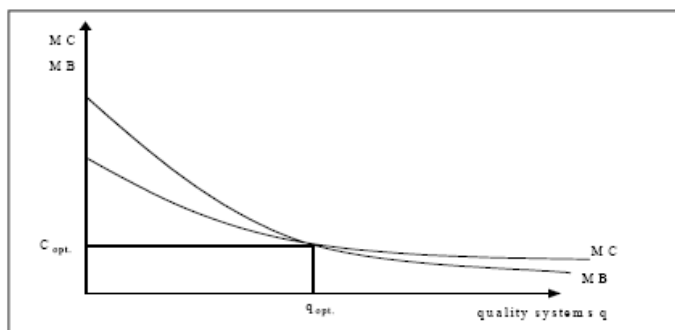


Figure 6 Relationship between the Number of Quality Systems and Cost/benefit (Krieger, 2002)

Table 1 Integration of EFSIS in a BRC-Certified Company

level of requirements	requirements	Additional requirements
Basic level		15
Higher level		3
Recommendations		18

6. CONCLUSION

This paper has given an overview of the variety of quality systems in the agribusiness and food industry in Europe. The main aspect was a cost/benefit analysis of quality management

systems in companies. The goal is the minimizing of costs in companies in due to reduction of double work.

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