

FACTORS ASSOCIATED WITH THE ADOPTION OF FOOD SAFETY CONTROLS BY THE MEXICAN MEAT INDUSTRY

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Abstract: Food marketing at international and domestic markets has focused on processing systems that improve food safety. The objective of this research is to determine the factors influencing the implementation of the HACCP system in the Mexican meat industry, and to identify the main marketing destination of their products. Only 18.5% of enterprises reports fully operational HACCP in their plants. The main destination of their production in the domestic market is supermarkets, suppliers and distributors and specific niches of the domestic market. Exports are to USA, Japan, Korea and Central America and some niches of the domestic market with requirements of higher quality. The four principal factors that motivate enterprises to adopt HACCP are associated with improvement of plant efficiency and profitability, adoption of good practices, improvement of product quality and waste reduction. It is concluded that Mexican enterprises adopt HACCP to successfully remain and face competition by foreign enterprises in the domestic market and to a lesser extent to compete in the international market.

Keywords: Factors, HACCP adoption, Mexican meat industry

1. INTRODUCTION

Food safety is the common ground for developing and developed countries in the food commercial trade (Maldonado et al., 2005). International and domestic markets experienced important changes due to the jointly application of government and private regulatory requirements and standards along all the food chain, in order to satisfy the increased demands for food safety. (Caswell et al., 1998). Meat industry in Mexico includes Federal Inspection Type (TIF) enterprises that slaughter domestic animals, and others that carry out transformation processes as cuts, boners, sausages and stuffers, meat patties, meat dehydration, preparation of diverse meat foods and tamales (SAGARPA, 2001). There is growing interest in food safety by local consumers that are better informed about disease outbreaks (OECD, 1999), which in turn has promoted more demanding market (Martin et al., 1993).

Along with a stiffer domestic market there is the increased competition of meat plants from countries that have Commercial Agreements with Mexico. Foreign enterprises offer food products processed under tighter safety controls (Caswell and Henson, 1997; Caswell et al., 1998), as Hazard Analysis Critical Control Points (HACCP) and international certification by the International Organization for Standardization (ISO 9000) (Caswell et al., 1998; Herrera, 2004). Government standards related to the food sector may be classified into two groups: one group is the set of standards that define type and final quality of the food product (Caswell and Johnson, 1991; Henson and Caswell, 1999; Henson y Caswell, 1999) and the other is the nutrimental information that must be provided to consumers by the enterprises (Henson, 1997). In Mexico, the National Plant and Animal Health and Food Safety and Quality Services (SENASICA), is the federal agency in charge of regulations and surveillance of food quality and safety (Constitución Política de los Estados Unidos Mexicanos, 2005; Ley de la Administración Pública Federal, 2003). Following political and economical demands of certain countries, food processing industries are required to apply effective food safety controls such as the HACCP System (Caswell and Henson, 1997), in addition to voluntary systems such as ISO 9000 and ISO 14000 (ISO, 1996; Noelke and Caswell, 2000). Food processing enterprises must face different economic and social factors, which determine the pressure in adopting these controls. These factors may be similar for enterprises that operate within the same sector, while among others, they arise from particular demands derived from the need to comply with regulations, avoid lawsuits related with food quality and safety, reduce internal and external costs or achieve a clear differentiation of product brand (Hooker and Caswell, 1999).

Therefore, the objective of this study is to define the nature of the motives that lead Mexican Federal Inspection Type (TIF) enterprises in the adoption of the HACCP system in their plants and the main market destination of their products.

2. MATERIALS AND METHODS

Field information for this study came from questionnaires (Henson et al., 1999; Maldonado et al., 2005; Martin et al., 1993) sent to the 160 TIF enterprises registered in the Official Listing of TIF Enterprises of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) (SAGARPA, 2001). Questionnaires were filled out by direct interview, this field phase was from 2000 to 2001; in 2003, and the enterprises identified with a fully operational HACCP system were revisited to validate the accuracy of the information given in the questionnaire.

The questionnaire included a list of factors that in previous studies (Carlsson and Carlsson, 1996; Tompkin, 1994) were proposed as determinants for the enterprises in the adoption of food safety protocols. In order to assure a positive evaluation of the main motives that lead meat processing plants to the implementation of HACCP system, the first step taken was the classification of enterprises by the level of adoption of this system. Then, further analyses were performed only within the group of enterprises that showed the HACCP fully implemented and functional in their plants; these enterprises were then classified by size following the Food Safety and Inspection Service (FSIS) criteria (FSIS, 1996). Enterprises were asked to grade the importance of each deciding factor based on the Likert scale, grades were from 1(very important factor) to 7(not-important factor). After that, with the purpose of better understanding the incentives that the enterprises had to adopt HACCP, a Principal Components Analysis (PCA) was used (Henson and Holt, 1999).

3. RESULTS

Ninety-two (57.5% of all registered Mexican TIF enterprises) answered and filled out the questionnaire. Within these enterprises four groups were identified in relation to the extent of adoption or interest in adopting the HACCP system (Table 1). Only 18.5% of the enterprises had fully operational HACCP system in their plants. Of the Mexican TIF enterprises that had an operational HACCP system 76.5% were small and medium size, while less than a third (23.5%) of this group was represented by large size

enterprises (Table 2). In general, fully implementation and operation of HACCP was relatively recent, since at least 75% of the enterprises did not have more than two years with HACCP system operating in their plants and approximately; 10% of them that had an operational HACCP at the time of the interview had it for about four years (Figure 1). These last enterprises could be considered the pioneers in the sector.

Table 1. Grouping of Mexican TIF enterprises based on HACCP implementation status

HACCP status	Number of enterprises	Proportion(%)
Fully operational	17	18.5
Being implemented	27	29.3
Planned but not implemented	30	32.6
No plans to implement	18	19.6

In relation to participation in foreign markets, 47% of the enterprises send approximately 17% of their production to export, and the domestic market took the 83% of the production. Distribution of production within the domestic market was: 63.3% went to national supermarket chains and nation-wide distributors; 16.9% went to the major caterers; 10.6% to meat plants for further processing; 5.3 and 3.9% to local wholesalers and final consumers, respectively. Therefore, the incorporation of the Mexican meat industry to international markets, in number and sale volumes, was incipient. Export destinations were USA, Japan, Korea, Central America and specific niches of the domestic market, such as transnational enterprises (restaurants and fast food chains).

Table 2. Size of Mexican TIF enterprises with fully operational HACCP

Size (number of employees)	Number of enterprises	Proportion (%)
Small (10 to 200)	7	41.2
Medium (201 to 500)	6	35.3
Large (over 500)	4	23.5
Total	17	100.0

Factors that the enterprises considered of greater importance to make a decision in favor of implementing HACCP were related with legal requirements compliance as demanded by domestic and international markets, having access to international markets, and to be certified by a third party (Table 3).

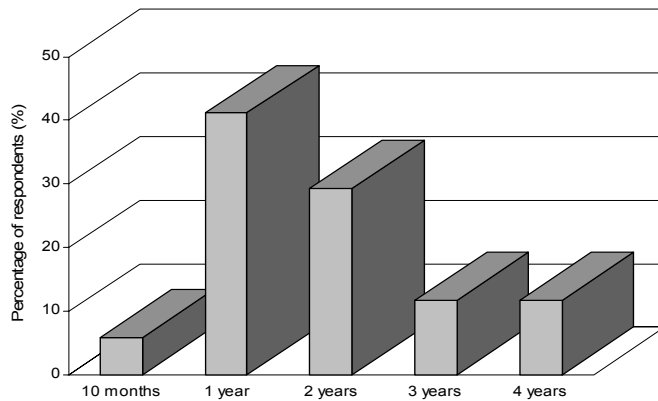


Fig. 1: Time intervals of Mexican TIF enterprises with fully operational HACCP

Seventy-one percent of the enterprises indicated that their current customers were asking them to have an operational HACCP system for all the products generated in their plants. This fact could indicate the importance that market regulations and incentives have on pressing Mexican meat enterprises to adopt food safety protocols.

Table 3. Mean importance scores in ascending order for factors influencing decision to develop/implement HACCP.

FACTOR	GRADE*
Legal requirements	1.24
Have access to international markets	1.41
Need of plant certification by a third party	1.71
Improve product quality	1.76
Attract new customers for their products	1.88
Comply with demands of most of their customers	1.94
Improve production process control	2.59
Maintain existing clientele	2.65
Improve plant efficiency / profitability	2.71
Because it was considered a good practice	3.53
Reduce need for quality auditing by customers	3.71
Reduce product waste	4.41
Recommended by commerce organization	5.06
Reduce client complaints	5.24

* Grade scale was from 1 (very important deciding factor) to 7 (not-important factor in the decision making).

Four factors explained 69.8% of the variance in the selection of the 14 reasons based on the need to have the HACCP system implemented (Table 4). To enable the advantages derived by the implementation of the HACCP system in their plants, the largest variation proportion factor (22.9%) included the following reasons: “plant efficiency and productivity

improvement” and “maintaining existing clientele”. Efficiency improvement is an internal factor, while clientele responds to a condition external to the plant.” This suggests that this factor is associated firstly with the plant efficiency and then through clientele benefits as a major benefit associated to the HACCP system implementation and operation.

The second factor (20.5%) included internal reasons, such as: “being a good practice” and “improving process control”. This suggests that only internal factors are influential to this group of enterprises in order to implement HACCP in their plants. Third and fourth important factors with a total variance of 13.7 and 12.7%, respectively, are also associated with internal reasons: “improving product quality” and “reducing product waste”, respectively. Both suggest that these factors are associated with the product improvement as a major benefit derived from the HACCP system implementation and operation.

Table 4. Factor loadings for motivation to implement HACCP derived from principal components analysis.

Reason for implementation of HACCP	Factor 1	Factor 2	Factor 3	Factor 4
Comply with demands of their customers	0.60610	0.04607	-0.43834	0.55344
Legal requirements	-0.07564	-0.31224	-0.02201	-0.58168
Improve production process control	0.37980	0.67632	-0.25184	-0.15528
Reduce product waste	-0.09597	0.43271	0.28037	0.66871
Reduce client complaints	0.44497	0.61000	0.38825	-0.12471
Improve plant efficiency / profitability	0.87042	0.05919	0.21612	0.15484
Improve product quality	0.48784	-0.04600	0.67501	-0.17888
Recommended by commerce organization	-0.31905	-0.36915	0.49419	0.47458
Reduce need for quality auditing by customers	0.61004	-0.51796	-0.18694	0.39521
Need of plant certification by a third party	-0.05413	-0.59356	-0.45168	0.29219
Because it was considered a good practice	0.03376	0.77908	-0.29799	0.07104
Maintain existing clientele	0.77150	-0.04119	-0.30656	-0.20216
Attract new customers for their products	0.54403	-0.53632	0.43462	-0.18414
Have access to international markets	-0.35003	0.29732	0.17489	0.19548
Proportion of variation explained	22.9	20.5	13.7	12.7

4. DISCUSSION

This analysis indicates that the adoption of the HACCP system is motivated by a wide range of factors, also reported in other studies (Caswell et al., 1998; Mortlock et al., 1999), which are related with internal and external factors to the enterprises. The most relevant internal factors for the TIF enterprises to make a decision to adopt the HACCP system are the fact of increasing plant efficiency and good practices during processing. To maintain existing clientele and comply with legal requirements are the most important external factors for this group of Mexican enterprises.

Probably the size of the enterprise is another factor that influences the incentives for implementing HACCP, since the largest ones are the first in adopting and operating the HACCP system in Mexico. Evidences found in other studies (Holleran and Bredahl, 1997; Mortlock et al., 1999), suggest that the largest enterprises adopted this system before the smallest enterprises because of their own benefit expectations.

Mexican enterprises with HACCP system are placed as the most efficient ones in Mexico, with a strong presence in the domestic market and strength to cope with transnational enterprises that are trying to gain customers in this Mexican market on the bases of low number of complaints from unsatisfied customers. Evidence suggests that enterprises adopted food safety protocols as a mean to avoid lawsuits due to defective or unhealthy products placed in the market (Buzby et al., 2001; Henson and Holt, 1999) and with this they keep their local markets (Buchanan and Whiting, 1998).

It is concluded that the adoption of HACCP and ISO 9000 is associated with the goal of increasing sales due to a certified improvement in product quality, in addition to improvements in efficiency and yields of all internal processes. Mexican TIF enterprises adopted HACCP and ISO 9000 to comply with international market regulations and in order to maintain domestic customers with higher level demands on food quality and safety food products.

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REFERENCES

- A.G. Herrera. The hazard analysis and critical control point system in food safety. *Journal of Methods in Molecular Biology*, 2004, 268:235-280.
- C. M. Noelke, J. A. Caswell. A Model of the Implementation of Quality Management Systems for Credence Attributes. PhD dissertation. Department of Resource Economics. University of Amherst, Massachusetts. 2000.
- Constitución Política de los Estados Unidos Mexicanos. Porrúa. México. 2005.
- E. Holleran, M. E. Bredahl. Food Safety, Transaction Costs, and Institutional Innovation in the British Food Sector. Working Paper 97-1, Center for International Trade Studies, Missouri University. Columbia, MO. 1997.

- FSIS. Food Safety Inspection Service. Pathogen reduction: Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule. Federal Register. 61(144):38805-38889. United States Department of Agriculture, Washington. 1996.
- ISO. ISO Standards Compendium-ISO 9000 Quality Management. International Organization for Standardization Geneva, Switzerland. 1996.
- J. A. Caswell, G. V. Johnson. Firm Strategic Response to Food Safety and Nutrition Regulation. In: Economics of Food Safety, Julie A. Caswell, (ed.). pp. 273-297. New York: Elsevier Science, 1991.
- J. A. Caswell, M. E. Bredahl, N. H. Hooker. 1998. How Quality Management Metasystems are affecting the Food Industry. Review of Agricultural Economics, 1998, 20: 547-557.
- J. A. Caswell, S. J. Henson. Interaction of Private and Public Food Quality Control Systems in Global Markets. Paper presented at the conference Globalization of the Food Industry: Policy Implications. September. The University of Reading, United Kingdom, 1997.
- J. C. Buzby, P. D. Frenzen, and B. Rasco. Product Liability and Microbial Foodborne Illness. Washington, DC. U.S. Department of Agriculture. Agr. Econ. Rep. No. 799. USDA/Economic Research Service, Food and Rural Economics Division, Washington, DC, 2001.
- Ley de la Administración Pública Federal 2003. Porrúa. México.
- M. Carlsson, D. Carlsson. Experiences of Implementing ISO 9000 in Swedish Industry. International Journal of Quality & Reliability Management, 1996, 13:36-47.
- M. P. Mortlock, A. C. Peters, C. J. Griffith. Food hygiene and hazard analysis critical control point in the United Kingdom food industry: practices, perceptions, and attitudes. Journal of Food Protection, 1999, 62:786-92.
- N. H. Hooker, J. A. Caswell. 1999. Two Case Studies of Food Quality Management Systems. Journal of International Food & Agribusiness Marketing, 11:57-71.
- OECD. Food Safety and Quality: Trade Considerations. Organisation for Economic Co-operation and Development. Paris. 1999.
- R. B. Tompkin, HACCP in the Meat and Poultry Industry. Food Control, 1994, 5:153-161.
- R. L. Buchanan, R. C. Whiting. Risk assessment: a means for linking HACCP plans and public health. Journal of Food Protection, 1998, 61:1531-1534.
- S. A. Martin, B. J. Bowland, B. Calingaert, N. Dean. Economic Analysis of HACCP Procedures for the Seafood Industry. North Carolina: Research Triangle Institute. 1993.
- S. E. Maldonado, S. J. Henson, J. A. Caswell, L. A. Leos, P. A. Martinez, G. Aranda, and J. A. Cadena. Cost-Benefit Analysis of HACCP Implementation in the Mexican Meat Industry. Food Control, 2005, 16:375-381.
- S. J. Henson, J. A. Caswell. Food Safety Regulation: An Overview of Contemporary Issues. Food Policy, 1999, 24:589-603.
- S. J. Henson, G. Holt, J. Northen. 1999. Cost and Benefits of Implementing HACCP in the UK Dairy Processing Sector. Food Control, 1999, 10:99-106.
- S. J. Henson, G. Holt. Exploring Incentives for the Adoption of Food Safety Controls: HACCP Implementation in the U.K. Dairy Sector. Review of Agricultural Economics, 1999, 22(2):407-420.
- S. J. Henson, J. A. Caswell. 1999. La regulación de la seguridad alimentaria: Perspectiva general de las cuestiones actuales. Revista Asturiana de Economía, 22:7-26.
- S. J. Henson. Costs and Benefits of Food Safety Regulations. Paris: Organization for Economic Co-operation and Development. 1997.
- SAGARPA. Directorio de Empresas Tipo Inspección Federal (TIF). Dirección de Rastros TIF. Dirección de Sanidad Animal. México. 2001.

LEVEL OF ADOPTION OF QUALITY MANAGEMENT SYSTEMS INTO THE MEXICAN PORK INDUSTRY

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Abstract: This research studies the characteristics of the Mexican pork sector; adoption status of quality management systems, and product destinations. Ninety six percent of fifty enterprises have fully answered a questionnaire. Ninety percent are small and medium-sized, the rest are large-sized firms. Nineteen percent of them have totally adopted HACCP, sixty three percent are implementing or planning to do it, the rest have no plans to adopt it. Thirteen percent of the enterprises had ISO 9000. Thirty four percent of their sales go to supermarkets, 57% to other retail chains and 9% to exportation. Product destinations are mainly Central America, United States of America, Asia and Mexico. To improve efficiency and the quality of process it is necessary to implement HACCP. Besides, customers and legal requirements are the external factors, which result in this adoption. In the process of implementing, there are some problems, such as staff motivation and training. The results suggest that HACCP system operating is important for the Mexican pork industry. It also has relevant implications in domestic trade. It is necessary to encourage adoption of quality management systems in the sector.

Keywords: Mexican Pork industry, HACCP, ISO 9000

1. INTRODUCTION

Food safety is the major focus of consumers, producers, industry groups and government agencies in the whole world. Sockett (1996) indicates that meat is an important agent of food-borne infections. However, consumers assume that safety in pork meat is crucial to reduce outbreak trends of human illness in domestic and foreign countries. The field of pork production has recognized the importance of having consumer's confidence in the pork product by offering a safe product. In order to obtain this consumer's recognition, food safety is an essential coordination of efforts throughout the food chain (Lautner, 2005). This means that research programs in production, processing, distribution, retail and consumer, need to be developed.

In general, it is accepted that Quality Management Systems (QMS) are the most effective means of ensuring the safety and quality of food that identify a series of food attributes (Caswell et al., 1998). The most important QMS in the food industry is HACCP (Hazard Analysis and Critical Control Points), which is now mandatory in some industries and countries, and ISO 9000 which is no mandatory. HACCP focuses to reduce food borne hazards throughout the food supply chain (FSIS, 1996; Hathaway and Cook, 1996) and ISO 9000 aims to standardize quality management and to facilitate communication in a set of international quality assurance standards that guarantee a consistent production process (Bredahl et al., 1997).

It is evident that implementation of HACCP within the Mexican pork industry sector has become widespread over last several years (Gallardo, 2005), and it is beneficial to the firm. Mexican meat industry includes Federal Inspection Type (TIF) enterprises that carry out slaughter domestic animals and/or diverse transformation processes. Food quality in these Mexican TIF enterprises is supervised by the Ministry of Agricultural, Livestock, Rural Development, Fisheries and Food (SAGARPA). These plants incorporate new control points for materials used to handle residues and to detect possible causes of ecological contamination (DGG-CEA, 2000). In addition, the National Food Safety and Quality Program (Programa Nacional para la Inocuidad y Calidad Alimentaria- PRONINCA) promote the implementation of HACCP in the processing and handling of fresh vegetables and meat processing and handling (SAGARPA, 2000).

On the other hand, Holleran and Bredahl (1997) developed a conceptual outline in order to analyze food safety. They observed that firms were motivated by internal and external factors when implementing ISO 9000. It was also found that ISO 9000 was particularly adopted by large firms due to internal operating efficiency and cost reduction. Alternatively, intra – and inter-firm factors are registered in adopting QMS such as HACCP and ISO

9000 (Fouayzi et al., 2005). Price premiums for better quality products, efficiency and improved management are included into the intra-firms factors, whilst inter-firm factors incorporated the improvement of the ability to identify other firms into the supply chain and better opportunities of having trade with them. The objectives of this paper are to characterize the Mexican pork sector, to explore the adoption status of Quality Management Systems (QMS) such as HACCP and ISO 9000, and to identify the reasons and problems faced by the enterprises to implement the systems and product destination.

2. MATERIALS AND METHODS

The data used in this study comes from a survey of firms in pork processing industry (Henson et al., 1999; Maldonado et al., 2005). The survey includes a series of questions intended to collect information about firm characteristics, customers and products, and the status of adoption of QMS as well as other relevant elements, such as the importance of factors in the decision to develop/ implement these two QMS and problems faced by the enterprises during the implementing process. Survey data is collected by direct interview of the General Manager and the Veterinarian assigned of each Pork Meat Federal Inspection Type (TIF) enterprises registered in the Official Listing of TIF Enterprises of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) from 2000 to 2001. The enterprises were revisited or phoned in 2003 to validate the accuracy of the information given in the questionnaire.

Respondents are presented with a list of factors that previous studies suggested can motivate the decision to implement QMS such as HACCP and ISO 9000 (Martin et al, 1993; Vanguard Consulting, 1993). Then, they are asked to indicate how important each of them have been in their decision, using a seven-point Likert scale ranging from “very important” (1) to “very unimportant” (7).

For the problems faced in the implementation and/or operation of these two QMS, enterprises are also asked to identify the relative importance on a seven-point Likert scale. The scale ranges from “major problem” (1) to “minor problem” (7) of a series of variables that previous studies have suggested can be difficulties in the implementing process of these two QMS (Institute of Quality Assurance, 1991; Tompkin, 1994). Chi-square tests are used to analyze the data using the Statistical Analysis System package (SAS, 2001).

3. RESULTS AND DISCUSSION

All the 50 firms that have answered the survey are members of the National Association of Enterprises Federal Inspection Type (ANETIF - the Trade Association of Meat Industry). Forty-eight (96.0%) of the questionnaires were fully completed. Twenty enterprises (41.7%) had between 51 and 200 employees that represent the size of most of the Mexican Pork TIF processing firms; 33.3% of the enterprises had between 201 and 500 employees; seven enterprises (14.6%) had less than 50 employees; and the remaining five (10.4%) registered more than 500 employees.

Fifty-two percent of the firms are established at the Center region of the country near the cities with heavy domestic trade markets. Forty six percent are settled at the north part where the other main market destination of pork meat products is located. Only 2.1% are found at the south region. Plants carry out four types of processes, sausage-making activities registered the major production level (37.5%), which clusters most of the enterprises; 35.4% of them were slaughterhouses. The rest of the plants concentrate their activities in prepared meals (6.3%), and cold cuts and packing (20.8%).

Additional details about the status of QMS, HACCP and ISO 9000 adoption by firms are presented in Fig. 1. Thirteen of the surveyed firms have two QMS, nine (18.8%) with HACCP under fully operation and four (8.3%) with ISO 9000 certification. It seems relevant the adoption of QMS for this group of processing industry. It may perceive benefits from QMS by dealing with other firms with adopted QMS, and having HACCP seems to be common business practice between them. As suggested in the literature, some firms require their suppliers to have QMS in place to reduce transaction costs associated with hesitation about the quality of the product they buy. Five out of nine enterprises with HACCP fully operating (55.6%) require suppliers to have QMS. Fouayzi et al., (2005) suggested that depending on enterprise position in the chain, it might be required to use specific QMS. Commonly, the leader in the supply chain has the most responsibility for assuring the quality of a product.

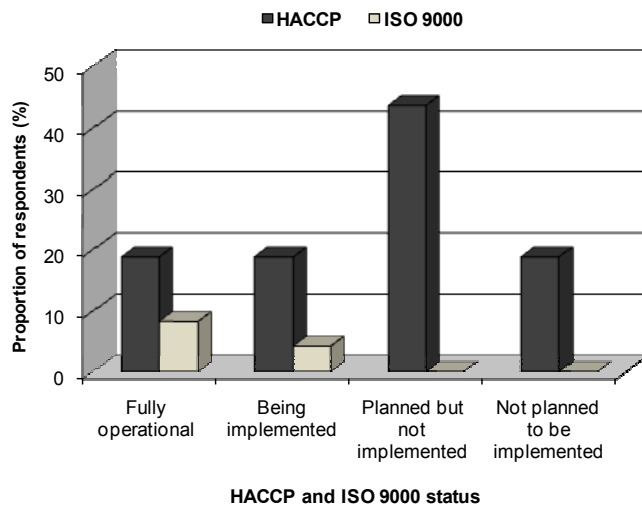


Fig. 1: HACCP and ISO 9000 status of plants that responded the survey

Besides, two more enterprises (4.2%) had the voluntary standard ISO 9000 in full operation, although the group is also formed for those nine with the status still of being operating HACCP (18.8%). This second group declared its interest to be included in the list of regular domestic and foreign suppliers. On the other side, 30 enterprises of pork meat TIF firms have Mexican Official Norms adopted/operating, but any QMS, nevertheless 21 (43.8%) were on the path of beginning to adopt HACCP system. They were mainly pulling off with structural changes of their plants, optimum staff training, and investment in new equipment. The last group of nine firms pointed out that they have no interest in adopting any QMS. The main factors for the decision are related with high costs of implementing/operating, not being a legal requirement in domestic market and not required by major customers. However, capacity for food safety remains far below international standards, and food safety requirements are considered as a significant barrier (Henson et al., 2000; Henson and Wilson, 2002) to markets of developed countries or even in domestic developing countries.

In the food industry, the supply chain can be represented by producer of raw good, as pork producers, who had recognized the importance of producing a product in which their domestic and international market and consumers could have the highest confidence. Then, the processors followed in this segment of chain can be more than one type. Subsequently, the wholesalers, retailers or caterers may follow and are in charge of selling the final product to consumers.

Additional details about the percentage of Mexican meat pork production and main market destination of the 48 TIF enterprises surveyed are registered in Table 1. They reported seven destinations for their production. Supermarkets had the highest proportion (35.0%), 30 firms participated of this proportion of market. This segment of sale chains frequently moves faster in the direction of certification and traceability requirements (Henson and Caswell, 1999), thus the quality control systems are highly required.

Table 1. Percentage of Mexican meat pork production and main marketing destination of the 48 TIF enterprises surveyed.

	Frequency	Percentage	Production (%)
<i>Sales destination</i>			
Supermarkets	30	62.5	35.0
Other retailers	11	22.9	7.5
Major caterers	34	70.8	32.3
Wholesalers	9	18.8	7.0
Final consumers	6	12.5	1.8
Other food processors	9	18.8	7.5
Exportation	17	35.4	8.9
Cumulative Frequency/Percentage			100.0
<i>Exportation</i>			
USA	9	18.8	14.4
Asia (Japan, Korea, China)	10	20.8	35.1
Puerto Rico	4	8.3	10.0
Central America	10	20.8	25.8
Cuba	1	2.1	5.3
Fast food chains and restaurants	2	4.2	9.3
Cumulative Frequency/Percentage			100.0

Major caterers consumed 32.3% of production, and the largest group of enterprises is working with them. Although 17 firms export, less than 10% of production is exported. That is, because capacity to implement effective food safety controls is of vital importance to food exports from developing countries. Henson and Wilson (2002) indicate that the exporting country must be able to comply with food safety requirements and to demonstrate that compliance has been achieved.

Six export destinations are related with this pork processing companies (Table 1). They reported that most of their production (35.1%) is shipped to Japan, Korea and China, however only ten firms share this trading relationship. There may be a couple of reasons to endorse the fact; it could mean the number of TIF pork slaughterhouses have improved their infrastructure and processing technology in 2001 due to financial support. However, through 2002 the increased trends of ten years of exportation went

down because major foreign marketing competence from USA and Brazil, and higher food safety standards took place in Japan (Gallardo, 2005).

Central America is the second destination for the Mexican pork meat (25.8%). It has lower quality standards and requirements. Less than 10% of the production goes to USA market; only nine Mexican enterprises participated of this market share. Henson et al., (2000) stated the necessity of the application of HACCP and other hygienic practices along the meat production chain when the goal is to export to most developed countries such as the USA. Those countries need a proof that food safety requirements are achieved. Domestic market with specific high pricing niches has 9.3% of the production and only two enterprises report relationship with them. Local markets in Latin America countries with these characteristics affect local producers by imposing quality and safety standards on them (Reardon and Berdegué, 2002).

Concerning the reasons to implement QMS, the overall analysis showed a difference ($P < 0.0001$) whether they were regarded as of major or minor importance by the industries. Improvement of product quality, the need of the plant to be third party accredited, and attraction of new customers for products were considered the major incentives for the enterprises (Table 2). The enterprises are interested in improving their product quality because the increased competence both at domestic and international levels. In addition, the firms third party accredited are able to export, and as consequence, they might attract new customers for their products. The results of this study are similar to those found by Deodhar (2003) for the Indian Food Processing Industry and by Semos and Kontogeorgos (2007) in northern Greece. On the other side, reduce product wastage, reduce customer complaints, and recommended by trade organization were reasons considered of minor importance. Since most of the enterprises are domestic market oriented, the compliment with a trade organization recommendation is not in their priorities: In a study in India, Deodhar (2003) reported that recommended by trade organization, and consignment rejection/retention were rated the lowest among all food categories and among all reasons in motivating adoption of HACCP. Similarly, Semos and Kontogeorgos (2007) found that reduced product wastage, reduced production costs, and increased product prices were the least important benefits of operating HACCP.

The overall analysis for problems perceived by the industries in implementing QMS showed a difference ($P \leq 0.0038$) whether they were regarded as of major or of minor importance (Table 3). Need to retrain both production staff and supervisory/management staff, and reduced staff time available for other tasks were considered as major problems. The low level of formal education, staff labour desertion, and the perception of being low-paid are cited among the reasons for these problems.

Table 2. Classification of incentives in implementing Quality Management Systems into the Mexican pork industry.

Incentives	I ^a	II ^b	Percentage ^a	Percentage ^b
To meet the needs of major customers	21	17	55	45
To meet legal requirements	22	10	69	31
Improve control of your production process	24	10	71	29
Reduce product wastage	11	25	31	69
Reduce customer complaints	11	23	32	68
Improve efficiency/ profitability of the plant	26	9	74	26
Improve product quality	31	6	84	16
Recommended by trade organization	14	23	38	62
Reduce need for quality audits by customers	17	19	47	53
Needed for plant to be third party accredited	28	7	80	20
Generally regarded as good practice	25	10	71	29
Hold onto existing customers for products	28	10	74	26
Attract new customers for products	27	7	79	21
Access new overseas markets	22	15	59	41

^aI= major incentive, ^bII=minor incentive

Table 3. Problems faced in implementing Quality Management Systems into the Mexican pork industry

Problem	I ^a	II ^b	Percentage ^a	Percentage ^b
Need to retrain production staff	8	0	100	0
Need to retrain supervisory/managerial staff	5	1	83	17
Attitude/motivation of production staff	5	4	56	44
Attitude/motivation of supervisory/managerial staff	2	4	33	67
Reduced flexibility of production staff	5	3	63	38
Reduced staff time available for other tasks	6	3	67	33
Recouping cost of implementing HACCP	3	3	50	50
Reduced flexibility to introduce new products	3	5	38	63

^aI= major problem, ^bII=minor problem

The results of this research are similar to those found by Deodhar (2003) in a study in India. In another study, Semos and Kontogeorgos (2007) found that need to retrain production staff, attitude/motivation of production staff, and reduced flexibility of production process were the main difficulties faced during HACCP operation in northern Greece. Meanwhile, attitude/motivation of supervisory staff, and reduced flexibility to introduce new products were considered as minor problems by the firms surveyed. However, in general, there were no incentives or formal programs for increasing staff motivation. Similarly, in India Deodhar (2003) found that attitude/motivation of supervisory/managerial staff, and reduced flexibility to introduce new products were regarded as less important by the enterprises surveyed. Semos and Kontogeorgos (2007) reported similar results in a survey to northern Greece food companies.

4. CONCLUSION

The study reports the particular characteristics of the Mexican pork TIF industry and destination of their production, and provides indications of internal and external incentives and problems associated with the implementation of HACCP and ISO 9000. The HACCP operation has been a respond to requests of international markets and very specific domestic niches, and less for local public demand. However, this industry needs to go ahead, in order to compete with foreign markets with higher quality products into a globalization trade holding higher rigorous standards. This kind of information is useful for understanding the key factor of QMS adaptation in Mexican pork industry. They can be a tool for improving management and production efficiency along the meat production chain, in order to compete onto domestic and foreign markets, where the demand of quality products is increasing.

REFERENCES

- A. Semos, A. Kontogeorgos. HACCP implementation in northern Greece: Food companies' perception of costs and benefits. *British Food Journal*, 2007, 109:5-19.
- B. Lautner. HACCP- Its Application for the Pork Industry. National Pork Producers Council. 2005-. Available at: <http://www.cvm.uiuc.edu/HACCP/Symposium/LAUTNER.HTM>
- DGG-CEA (Dirección General de Ganadería y Centro de Estadística Agropecuaria). Situación actual y perspectiva de la producción de carnes en México 1990-2000. Elaborado por el Centro de Estadística Agropecuaria y la Dirección General de Ganadería y el apoyo del Departamento de Agricultura de los Estados Unidos de América (USDA). México, D. F. 2000.
- E. Holleran, M. E. Bredahl. Food safety, transaction costs, and institutional innovation in the British food sector. Working Paper 97-1, Center for International Trade Studies. Missouri University. Columbia, MO. 1997.
- FSIS. Pathogen reduction: Hazard Analysis and Critical Control Point (HACCP) systems; Final Rule. Federal Register. 61(144), 38805-38889. Food Safety Inspection Service. United States Department of Agriculture, Washington, D. C. 1996.
- H. Fouayzi, J. A. Caswell, N. H. Hooker.. Motivations of Fresh-Cut Produce Firms to Implement Quality Management Systems. *Review of Agricultural Economics*, 2005, 28:132-146.
- Institute of Quality Assurance (IQA). An IQA survey on the use and implementation of BS 5750 standards by third party assessment bodies as seen by the end user". Institute of Quality Assurance. London, U. K. 1991.
- J. A. Caswell, M. E. Bredahl, N. H. Hooker. How Quality Management Metasystems are affecting the Food Industry. *Review of Agricultural Economics*, 1998, 20:547-557.
- M. E. Bredahl, E. Holleran, L. Zaibet. ISO 9000 in the UK Food Sector. Working Paper 97-2. Center for International Trade Studies, Missouri University, Columbia, MS. 1997.
- N. J. Gallardo. Situación actual y perspectivas de la producción de carne de porcino en México 2005. Coordinación General de Ganadería. Secretaría de Agricultura, Ganadería,

- Desarrollo Rural, Pesca y Alimentación. 2005. Available at: <http://www.sagarpa.gob.mx/Dgg/estudio/sitpor05.pdf>
- P. N. Sockett . The epidemiology and costs of diseases of public health significance, in relation to meat and meat products. *Journal Food Safety*, 1995, 15: 91-112.
- R. B. Tompkin. HACCP in the meat and poultry industry. *Food Control*, 1994, 5:153-161.
- S. A. Martin, B. J. Bowland, B. Calingaert, N. Dean. Economic analysis of HACCP procedures for the seafood industry. North Carolina. Research Triangle Institute. 1993.
- S. E. Maldonado, S. J. Henson, J. A. Caswell, L. A. Leos, P. A. Martinez, G. Aranda, J. A. Cadena, 2005. Cost-benefit analysis of HACCP implementation in the Mexican meat industry. *Food Control*, 2005, 16:375-381.
- S. Hathaway, R. L. Cook. A regulatory perspective on the potential uses of microbial risk assessment in international trade. Paper presented at the Second International Conference on Predictive Microbiology Power with Precision. Hobart, Australia. February 18-22, 1996.
- S. J. Henson, G. Holt, J. Northen. Cost and benefits of implementing HACCP in the UK dairy processing sector. *Food Control*, 1999, 10:99-106.
- S. J. Henson, J. A. Caswell. Food safety regulation: An Overview of Contemporary Trends. *Food Policy*, 1999, 24:589-603.
- S. J. Henson, J. Wilson. Understanding the nature of sanitary and phytosanitary capacity. World Bank. Washington, D. C. 2002.
- S. J. Henson, R. Loader, A. Swinbank, M. Bredahl, N. Lux. Impact of Sanitary and Phytosanitary Measures on Developing Countries. University of Reading. Centre for Food Economics Research. Reading, U. K. 2000.
- S. Y. Deodhar. Motivation for and cost of HACCP in Indian food processing Industry. *Indian Journal of Economics and Business*, 2003, 2:193-208.
- SAGARPA (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación). Programa nacional para la inocuidad y calidad (PRONICA). México, D. F. 2000.
- SAS. 2001. SAS/STAT User's Guide (Release 8.2). Cary NC, USA: SAS Inst. Inc.
- T. Reardon, J. A. Berdegue. The Rapid Rise of Supermarkets in Latin America: Challenges and Opportunities for Development. *Development Policy Review*, 2002, 20(4): 371-388.
- Vanguard Consulting. BS 5750 Implementation and Value Added. Vanguard Consulting, Ltd. Buckingham, U. K. 1993.