

Evaluation of food safety management systems in Serbian dairy industry

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Abstract

This paper reports incentives, costs, difficulties and benefits of food safety management systems implementation in the Serbian dairy industry. The survey involved 27 food business operators with the national milk and dairy market share of 65 %. Almost two thirds of the assessed dairy producers (70.4 %) claimed that they had a fully operational and certified HACCP system in place, while 29.6 % implemented HACCP, but had no third party certification. ISO 22000 was implemented and certified in 29.6 % of the companies, while only 11.1 % had implemented and certified IFS standard. The most important incentive for implementing food safety management systems for Serbian dairy producers was to increase and improve safety and quality of dairy products. The cost of product investigation/analysis and hiring external consultants were related to the initial set-up of food safety management system with the greatest importance. Serbian dairy industry was not greatly concerned by the financial side of implementing food safety management systems due to the fact that majority of prerequisite programmes were in place and regularly used by almost 100 % of the producers surveyed. The presence of competency gap between the generic knowledge for manufacturing food products and the knowledge necessary to develop and implement food safety management systems was confirmed, despite the fact that 58.8 % of Serbian dairy managers had university level of education. Our study brings about the innovation emphasizing the attitudes and the motivation of the food production staff as the most important barrier for the development and implementation of HACCP. The most important identified benefit was increased safety of dairy products with the mean rank scores of 6.85. The increased customer confidence and working discipline of staff employed in food processing were also found as important benefits of implementing/operating HACCP. The study shows that the level of HACCP implementation was high, either as standalone food safety system or incorporated in the ISO 22000 and its benefits to the dairy industry in Serbia were significant.

Key words: food safety management, incentives, costs, difficulties, benefits, dairy industry

Introduction

It is well known that milk and dairy products are indispensable components of the food supply chain since milk is an excellent source of nutrients for humans. Therefore, the total annual worldwide milk production in 2013 of 782 million tons with 27 % share of European countries (IDF, 2013) was not a surprise. The average milk production in Serbia has been estimated to 1.6 million tons per year while 52 % of it was delivered to dairy plants for further processing (Tomic and Sevarlic, 2010). Currently, there are more than 200 registered dairies in Serbia, but only 123 of them are active. Depending on processing capacities, Serbian dairies can be categorized as follows: (i) plants with capacity over 20,000 litres of milk/day, (ii) plants with capacity below 20,000 litres of milk/day and (iii) small craft dairies with daily capacity below 3,000 litres/day (Report, 2012). Big dairies own 90 % of total country's production capacity, medium sized 6.0 %, whereas small dairy companies only have 4.0% of the market share (van Berkum, 2010).

A total of 193 outbreaks and 6,053 illnesses in USA from 1990 to 2005 were linked to dairy products such as cheese, milk and ice cream. Milk was the vehicle in 67 outbreaks with 1,788 illnesses, cheese was identified in 57 outbreaks with 1,850 illnesses and ice cream was identified in 49 outbreaks with 1,879 illnesses. Dairy products identified as unpasteurised were associated with 30 % of the dairy-related outbreaks, including nearly 70 % of milk outbreaks (Arvanitoyannis et al., 2009). Milk was identified as the vehicle of infection in approximately 1-6 % of the human outbreaks reported in developed countries (EFSA, 2014; Gillespie et al., 2003), while milk and dairy products were implicated in 1-5 % of the total bacterial foodborne outbreaks, with 39.1 % of them attributed to milk, 53.1 % to cheese and 7.8 % to other milk products (De Buyser et al., 2001).

In outbreaks associated with dairy items, *Salmonella spp.* and *Campylobacter spp.* were the most common hazards (Arvanitoyannis et al., 2009). These past foodborne outbreaks awakened concerns that prevailing mechanisms of controls and management of food safety were inefficient and ineffective. Therefore the principles of Hazard Analysis and Critical Point Analysis (HACCP) was introduced and has become the worldwide-recognised method for food safety management,

since the FAO/WHO Codex Alimentarius Commission adopted the application of the principles in 1993. The HACCP system was developed to help manufacturers to produce safe food. It was designed to identify hazards and to establish and monitor controls. An HACCP plan proves that the controls are in place and that the system is functioning effectively (FAO, 1998). The dairy industry presents a unique and complex problem for the implementation of HACCP. Recent studies revealed an increase in the adoption of additional quality assurance (QA) and food safety management standards (FSMS), like British Retail Consortium (BRC), International Featured Standards (IFS), and ISO 22000, by dairy industry across Europe (Escanciano and Santos-Vijande, 2014; Arvanitoyannis et al., 2009; Trienekens and Zuurbier, 2008; Neeliah and Goburdhun, 2007)

In Serbia, the mandatory adoption of the HACCP principles was firstly introduced by virtue of the Veterinary Law (Law, 2005) which obliged all food business operators in the sector of food of animal origin, regardless of their size, to adopt and implement a food safety management system (FSMS) based on the principles of Good Hygiene Practice (GHP) and Good Manufacturing Practices (GMP) and the principles of HACCP. For all HACCP implementation activities a deadline was set for January 1st 2009. In the process of the harmonization of regulations of the Republic of Serbia with the European Union regulations and standards, with Serbia being today EU candidate country since March 2012, a new Food Safety Law was adopted in 2009 (Law, 2009). The most recently accepted regulation extended the HACCP deadline for all food sectors till June 11th 2011.

To the best of our knowledge, information regarding HACCP or any other FSMS implementation in the Serbian food sector was reported only for meat industry (Tomašević et al., 2013). The present study offers additional information about the FSMS implementation in the Serbian food industry. The main objective was to investigate the degree to which the dairy establishments implemented the FSMS and to document the importance of different incentives, difficulties and costs they faced during the implementation as well as benefits they derived afterwards. In addition, this survey illustrates differences regarding FSMS implementation in Serbian and other dairy industries.

Material and methods

The survey was conducted during the 18 months period after the regulation regarding compulsory HACCP implementation in Serbian food industry came into force. It was conducted on voluntary bases involving 27 producers of milk and dairy products. Based on the available literature (Henson et al., 1999; Herath and Henson, 2010; Maldonado et al., 2005), a questionnaire of 11 questions was developed to identify the effects of HACCP implementation in Serbian dairy industry which included the issues regarding general information about the food business operators (such as the number of employees, status of HACCP system, the information about the educational level, age, work experience and number of HACCP team members). Questions related to pre-requisite programs that are implemented in the company were also included. Further questions were related to the incentives for implementing HACCP system, costs, benefits and difficulties in implementation/operation of HACCP system, time necessary for HACCP implementation, food safety management system certification. All producers were visited and on-site interviews were performed. Respondents were mainly HACCP team leaders, production managers or owners and ranked the examined factors in order of importance according to their own conditions and experiences. The Statistical Package for the Social Sciences (SPSS - Release 17.0.0) was used for the data analysis.

Results and discussion

Size of the companies that responded to the survey classified by the number of employees (Table 1) was as followed: 25.9 % of the companies employ less than 10 people, 25.9 % employ between 11 and 50, 37.0 % employ between 51 and 250 and only 11.1% of the companies employ more than 250 employees. According to the enterprise size class breakdown defined by the European Commission (Eurostat), 87 % of the surveyed companies were micro, small and medium enterprises, while only 11.1 % of them could be regarded as large ones. From 27 companies that responded to the survey, 19 companies (70.4 % of the sample) claimed to have a fully operational and certified HACCP system in place, while 8 companies (29.6 %) implemented HACCP,

but they had no third party certification at the time the survey was conducted. In addition to the HACCP system, 8 companies (29.6 %) also implemented and certified food safety management system ISO 22000, whereas only two companies (11.1 % of the sample) had implemented and certified IFS standard (Table 2). Although the present survey covered 22 % (27) of all active dairy producers (123) in Serbia, national market share of the companies involved was above 65 %.

The present survey showed that all surveyed Serbian companies implemented HACCP. 10 years ago a similar survey was performed in Poland (Konecka-Matyjek et al., 2005) which was a candidate country to the European Union at the time. The obtained results showed only 11 % of dairy companies to have had implemented HACCP system while 56 % of them were in the process of implementing HACCP. In Japan a voluntary HACCP and GHP based approval system was introduced to milk and dairy products. A survey regarding HACCP-based FSMS in milk processing plants revealed that 69 % of participating facilities had a HACCP approval by the Japanese government. Three out of four companies without HACCP approval in Japan were small companies. Eight out of eight dairy plants in our survey without third party certification were also small enterprises, which once again confirmed the fact that small plants face more hurdles when implementing quality assurance standards and guidelines and maintaining their FSMS (Fielding et al., 2005; Fielding et al., 2011; Violaris et al., 2008; Dzwolak, 2014). It was already recognized that larger companies generally had better food safety management systems in place (Kök, 2009), so it was not surprising that the two largest dairy plants in the present survey also had a certified IFS standard. ISO 22000 was developed in cooperation with the European Committee for Standardization (CEN). Thus all CEN members (29 countries at present) were advised to translate and adopt ISO 22000 as a national standard within 6 months after the publication date and to withdraw any national standard which might be contradictory (Papademas and Bintsis, 2010). So far, 8 Serbian dairy plants which took part in the present investigation (29.6 %) should have no problems adapting to the requirements of the ISO 22000 standard when exporting to the CEN members, since they have already successfully

Table 1. Number of survey respondents by number of employees (n=27)

Number of employees	Number (%)
less 10	7 (25.9 %)
11 to 50	7 (25.9 %)
51 to 250	10 (37.0 %)
above 251	3 (11.1 %)

Table 2. Status of HACCP system and other food safety management systems for the companies responding to the survey (n=27)

Status	Number (%)
Fully operational and certified HACCP system	19 (70.4 %)
Operational HACCP system without certification	8 (29.6 %)
Fully operational and certified ISO 22000 standard	8 (29.6 %)*
Fully operational and certified IFS standard	2 (7.4 %)**

*Companies having both HACCP and ISO 22000

**Companies having both HACCP and IFS

certified it. Such results indicate much higher rate of the adoption of ISO 22000 in comparison to, for instance, only 2.6 % of certified food and beverage companies in New Zealand (Chen et al., 2015) or 5,8 % of the food establishments in the UK (Mensah and Julien, 2011).

Among the 27 surveyed Serbian dairy enterprises with a fully operational HACCP, 18 (66.7 %) also adopted ISO 9001 quality management standard. Similarly to the Serbian meat enterprises, ISO 9001 standard was also adopted first and was followed by the implementation of HACCP which was regarded to be the easier way to get a fully operational HACCP system on site (Tomašević et al., 2013). Similar observations were detected in Greece where the majority of the companies who had a certified HACCP system also had a certified ISO 9001 system (Semos and Kontogeorgos, 2007).

The respondents were asked to indicate how long it took them to implement fully operational HACCP system. Almost 60 % of the Serbian dairy industries estimated that period to be approximately 12 months, while only 14.8 % estimated the longer

time. Such result were almost identical to the UK dairy industry practice, where around 80 % of respondents estimated a period of 12 months or less to implement HACCP in their plants, with a small but not insignificant minority (around 12 %) that estimated the required time period to more than 18 months (Henson et al., 1999). To our surprise, a large fraction of Serbian dairy companies (26 %) were not able to provide a clear answer to this question.

Demographic information related to characteristics of HACCP team members for dairy producers is presented in Table 3. The majority of companies had less than 5 people in the HACCP team (55.6 %), while only 11.1 % had more than 10 employees in the HACCP team. Most of the HACCP team members had a college or university education (71.2 %), while only 1.3 % had solely primary education. Such results are in complete contrast to the education level of the Turkish dairy managers where only 32.1 % of them had an university education and where employment of plant managers with high education levels could further enhance FSMS application (Karaman et al., 2012). According to the Chinese study, the higher education level of the managers, the more likely it was that the company will adopt the HACCP system. The educational status of the Chinese food managers was similar to the situation in Serbian dairy and meat sector (Tomašević et al., 2013), where 77.3 % of them, from food business operators that had implemented the HACCP system, had a college and above dominate degree (Jin et al., 2008).

Regarding the age, majority of HACCP team members were between 30 and 50 years old (75.8 %), with 39.9 % having between 5 and 15 years of experience and 28.8 % having between 15 and 25 years of experience in food sector. Such findings were similar to the situation in the Chinese food industry where the average age of the food safety managers was 35 years with the majority of them (more than 70 %) under 40 years of age (Jin et al., 2008). Predominant professions among the Serbian dairy HACCP team members were food technologists (34.6 %), followed by economists (11.8 %) and veterinarians (6.5 %). Other, such as chemists, managers and civil engineers were represented with 6.5 % of all professions (Table 3).

Table 3. The structure of HACCP teams in companies that responded to the survey

Number of HACCP team (n=27)	Number (%)
Less than 5	15 (55.6 %)
Between 5 and 10	9 (33.3 %)
More than 10	3 (11.1%)
Educational level (n=153)	
Primary school	2 (1.3 %)
Secondary school	42 (27.5 %)
College	19 (12.4 %)
University	90 (58.8 %)
Age (n=153)	
30 years or younger	23 (15.0 %)
Between 31-50 years	116 (75.8 %)
Older than 51 years	14 (9.2 %)
Years of work experience (n=153)	
Less than 5 years	33 (21.6 %)
Between 5 and 15 years	61 (39.9 %)
Between 15 and 25 years	44 (28.8 %)
More than 25 years	15 (9.8 %)
Profession (n=153)	
Food technologist	53 (34.6 %)
Veterinarian	10 (6.5 %)
Chemist	2 (1.3 %)
Civil engineers	6 (3.9 %)
Economists	18 (11.8 %)
Managers	2 (1.3 %)
Other	62 (40.5 %)

Table 4. Rank scores of incentives implementing HACCP system (n=27).

Incentives	Mean scores*
Increase product safety	6.74 ^a
Increase product quality	6.59 ^a
Comply with customer requirement	5.96 ^b
Comply with regulatory requirement	5.85 ^b
Marketing	5.81 ^b
Access to new market (export)	5.77 ^b
Reduce production cost	5.41 ^b

*7 - very important and 1 - not important; Note: items denoted with the same letter are not significantly different at $\alpha = 0.05$ (95 %) level based on Wilcoxon signed rank test.

Incentives of implementing HACCP in Serbian dairy industry

The respondents were asked to rank incentives for implementing HACCP system in their company in order of importance, using a seven-point Likert scale ranging from very unimportant (rank 1) to very important (rank 7). The obtained results were presented with the mean score for each rank (Table 4). Accordingly, the most important motive for implementing HACCP system for Serbian dairy producers was to increase and improve safety of their products. Such results represent a huge difference in attitude compared to a large percentage (53.6 %) of Turkish dairy managers disagreeing that a HACCP-based food safety system was necessary to improve food safety practices in their plants (Karaman et al., 2012). Half of the Spanish food industry respondents thought that HACCP was useful and had a long term benefits. However 18.7 % among them also thought it was a waste of time (Ramírez Vela and Martín Fernández, 2003).

The second most important incentive for the Serbian dairy producers to implement HACCP was the quality increase of their products (Table 4) which could be unexpected since HACCP was designed primarily with the food safety in mind. Furthermore, our findings were not unique since the product quality improvements were found to be the major incentive for FSMS compliance in UK food sector (81 %) (Mensah and Julien, 2011) and in Chinese food plants without a HACCP system in place (Jin et al., 2008) as well.

Serbian dairy industry wanted to comply and meet regulatory requirements (rank 5.85) indicated in the new Food Safety Law (Law, 2009) which was comparable to the situation in UK where 60 % of food managers were HACCP driven by regulatory requirements (Mensah and Julien, 2011). On contrary the Chinese food producers ranked the same incentive ("to comply with regulatory requirements") only with 1.92 (Bai et al., 2007).

The incentive to comply with customer requirements was highly ranked by Serbian dairy producers (5.96) as well as in Portugal (Teixeira and Sampayo, 2011) or even Zimbabwe (Macheka et al., 2013). Market oriented incentives for HACCP implementation were less important (5.77) (Table 4), unlike for Chinese food producers, whose main reason for implementation of HACCP system was

to assess the new export markets and to increase market share, mainly those in America, Japan and European Union (Bai et al., 2007). Similarly to the Serbian meat sector (Tomašević et al., 2013), the least important incentive for HACCP implementation in the Serbian dairy industry was the reduction of production costs, too.

Regarding governmental incentive for the FSMS implementation, we would like to stress that the financial support by the Ministry of Agriculture of the Republic of Serbia and international donors in the period of 2004-2010 was around 6.000.000 € and was received by 1367 different food producers (4000 €/per plant on average) (Kalac, 2011). This was far from the situation in the UAE where the government's dedicated role was an essential driving force to encourage the implementation of a HACCP-based food control system (Al-Kandari and Jukes, 2011). However, it was better than the position of the Turkish dairy industry where the financial support from governing bodies was absent (Karaman et al., 2012).

Costs of implementing and operating HACCP in Serbian dairy industry

The respondents were presented with different costs related to the implementation/operation of HACCP system in their companies. They were asked to rank the individual cost in order of importance in the overall cost of implementing/operating HACCP system in their own company, using a seven-point Likert scale ranging from very unimportant (rank 1) to very important (rank 7). The obtained results were presented with the mean score for each rank (Table 5). Unlike the Serbian meat producers that perceived an investment in the new equipment as the most important cost when implementing HACCP (Tomašević et al., 2013), their dairy colleagues put the cost of a product investigation/analysis on the top of their financial concerns (Table 5). Although it was logical to assume that HACCP would minimize analyses by focusing on critical control points (CCP), the Greek food companies also perceived the cost of analysing products as the most important one during the HACCP operation (Semos and Kontogeorgos, 2007). Following the implementation of non-regulatory FSMS, food and beverage producers in New Zealand experienced increases in the costs of laboratory tests (Chen et al., 2015) too.

Table 5. Mean rank scores for the importance of different costs of implementing/operating HACCP in Serbian dairy industry (n=27)

Cost	Mean scores*
Product investigation/analysis	5.93 ^a
External consultants	5.62 ^{a,b}
Investment in new equipment	5.44 ^{a,b,c}
Staff training	5.44 ^{a,b,c}
System documentation	5.44 ^{a,b,c}
Civil works in the plant	5.04 ^{b,c,d}
Staff time in documenting system	5.00 ^{c,d,e}
Structural changes to plant	4.85 ^{d,e}

*7 - very important and 1 - not important. Note: items denoted with the same letter are not significantly different at $\alpha = 0.05$ (95 %) level based on Wilcoxon signed rank test

The cost of hiring external consultants in Serbian dairy industry was rated as the second most important (Table 5). Such findings were contradictory to previous assumptions that with increasing education level of dairy plant managers the need for external consultation would decrease (Karaman et al., 2012). The present study confirmed previous conclusions that even the relatively high educational level of food managers possessing generic knowledge and competence for manufacturing was inadequate itself to develop and implement an FSMS. Thus a competency gap was present so the vast majority of the northern Greek food companies (89.2 %) used with more than half (57 %) of them are still using an external consultant to develop and implement their HACCP system (Semos and Kontogeorgos, 2007). As far as UK dairy industry is concerned, 16.7 % of respondents estimated external consultants to be the most important cost associated with the implementation of HACCP, while 55.1 % of respondents had not incurred this cost at all (Henson et al., 1999). A recent study performed by Mensah and Julien (2011) in the UK food sector confirmed that external agencies were still contracted for validation and verification of FSMS. There were cases where more than 60 % of all food companies considered 'External Consultants' cost as a major cost item likewise in India (Deodhar, 2003).

According to the Serbian dairy producers, staff training, investments in new equipment and system documentation were the costs with the same mean rank score of 5.44 (Table 5), indicating that during their importance during the process of HACCP development and implementation. In the UK dairy sector the cost of record keeping was most frequently ranked as the greatest (Henson et al., 1999). Staff time in documenting HACCP was ranked lower (5.00) in our study. The least importance was given to the cost related to the structural changes in the plant (4.85) (Table 6) which was mainly connected to HACCP implementation. The data from Turkish dairy industry also indicated the intensity of documentation required during the establishment of HACCP were not important impediment to apply in food safety systems (Karaman et al., 2012). The important regional differences in FSMS implementation could easily be perceived by the fact that the second most important cost for northern Greece food producers was the investments in new equipment (Semos and Kontogeorgos, 2007).

Difficulties of implementing and operating HACCP in the Serbian dairy industry

Respondents were asked to indicate the importance of each difficulty faced in implementing/operating HACCP system on a seven-point Likert scale from very unimportant (rank 1) to very important (rank 7). The results indicated the major difficulty encountered during HACCP implementation and operation to be associated with the attitude/motivation of production staff (5.85) as well as the need to retrain production (5.70) and managerial staff (5.70). Attitude and motivation of managerial staff was perceived as less important struggle (5.41) compared to the production staff (Table 6). It was largely accepted that risk management strategies work only if they were internalised by all company employees, and that a successful implementation of HACCP demands a commitment of the whole personnel (Mortimore, 2001). Many previous studies emphasised the attitude of company managers as an important barrier for the development and implementation of HACCP (Ramírez Vela and Martín Fernández, 2003; Herath and Henson, 2010; Papademas and Bintsis, 2010). However, the present study brings about the innovation emphasizing the attitudes and the motivation of the food production staff.

The so called “technical barriers” that among other things involve attitude, education and training of the personnel, seemed a formidable hurdle to overcome since they encompass all practices and perceptions that negatively affect the understanding and proper and effective implementation of the HACCP principles (Panisello and Quantick, 2001). Recent behavioural studies from the United Kingdom (Taylor and Taylor, 2004), Italy (Angelillo et al., 2001), the United States (Henroid and Sneed, 2004), Poland (Konecka-Matyjek et al., 2005) and the Philippines (Azana and Zamora-Luna, 2005) asserted that such barriers were of a universal nature.

Serbian meat producers' major difficulty was associated with finances, i.e. the fact that companies were not able to recoup costs related to the implementation/operation of HACCP system (Tomašević et al., 2013). Unlike that, Serbian dairy producers ranked the finances as the fifth highest mean score of (5.15) (Table 6). The cost of adopting HACCP was also the primary barrier in 46.4 % Turkish dairy (Karaman et al., 2012), 26 % of UK (Mensah and Julien, 2011) and only 23.3 % of Zimbabwean food plants (Macheka et al., 2013).

The possible explanation for such results could be found in previously published marketing studies focused on implementation and maintenance of HACCP in a pasteurized milk plant (Roberto et al., 2006). The results suggested that a previous compliance of GMP/GHP prerequisites is essential for developing an effective HACCP plan with low number of CCPs, leading to lower costs and investments for implementation and maintenance of HACCP. With the compliance of the prerequisite programmes (PRP) (GMP/GHP), Brazilian milk plant was able to reduce HACCP costs approximately by 24.2 %. This fact emphasized the importance of a solid prerequisite programme to improve economic viability for HACCP implementation, which was exactly the same as in the case of Serbian dairy industry.

Cleaning and sanitation, personal hygiene, equipment maintenance and calibration, pest, water and temperature control together with traceability was used by almost 100 % (Table 7) of the Serbian dairy plants covered by the present survey. More than 80 % of respondents were managing waste and waste water and had an incoming control of raw material. This is exactly why the lack of pre-requisite programs/good hygienic or manufacturing practice

was noted as the least important difficulty (Table 6). It is interesting to note that air control and allergen labeling were least practiced PRPs in both Serbian dairy and meat industry (Tomašević et al., 2013).

Table 6. Mean rank scores for difficulties faced when implementing/operating HACCP in Serbian dairy industry (n=27)

Factor	Mean score*
Attitude/motivation of production staff	5.85 ^a
Need to retrain production staff	5.70 ^{a,b}
Need to retrain supervisory/managerial staff	5.70 ^{a,b}
Attitude/motivation of supervisory/managerial staff	5.41 ^{a,b}
Recouping costs of implementing HACCP	5.15 ^{a,b,c}
Reduced staff time available for other tasks	5.07 ^{b,c,d}
Reduced staff time to introduce new products	4.42 ^{c,d}
Lack of support of inspection service/governmental institutions	4.31 ^{d,e}
Lack of pre-requisite programs/good hygienic or manufacturing practice	3.38 ^e

*7 - very important and 1 - not important. Note: items denoted with the same letter are not significantly different at $\alpha = 0.05$ (95 %) level based on Wilcoxon signed rank test

Table 7. The percentage of survey's respondents using pre-requisite programs (n=27). Respondents could choose more than one answer

PRPs	Percentage
Cleaning and sanitation	100 %
Personal hygiene	100 %
Technical equipment maintenance and calibration	100 %
Pest control	96 %
Water control	96 %
Temperature control and record	96 %
Traceability	96 %
Waste and waste water management	89 %
Incoming control of raw material	85 %
Production layout	74 %
Allergen labelling	56 %
Air control	41 %

Benefits of implementing and operating HACCP in Serbian dairy industry

The respondents were asked to indicate the importance of each benefits of implementing/operating HACCP system observed on a seven-point Likert scale from unimportant (rank 1) to very important (rank 7). The benefits perceived by Serbian dairy producers are presented in Table 8. The most important identified benefit was the increased safety of food products with mean rank scores 6.85. This result was in agreement with findings in the British (Mensah and Julien, 2011), New Zealand (Chen et al., 2015) and Zimbabwe food sector as well as the Serbian meat industry (Tomašević et al., 2013). Official data regarding the food in the Republic Serbia for 2009 and 2011 showed a decrease in the number of non-compliant samples. In 2009 the results of laboratory inspection of foodstuffs showed that among total number of samples inspected for microbiological safety only 6 % in 2009 and 0.54 % in 2012, respectively, were non-compliant (Health Statistical yearbook of Republic of Serbia 2009, 2012).

The increased customer confidence was ranked as the second most important benefit (Table 8) which was similar to the UK dairy industry experience where the ability to retain existing customers

Table 8. Mean rank scores for benefits of implementing/operating HACCP in Serbian meat industry (n=27)

Factor	Mean score*
Increased safety of the products	6.85 ^a
Increased customer confidence	6.41 ^b
Increased quality of the products	6.22 ^{b,c}
Increased working discipline of staff	6.00 ^{b,c,d}
Increased product sales	5.59 ^{c,d}
Legal instrument against complains	5.56 ^{c,d}
Increased ability to access new overseas markets	5.48 ^d
Increased product shelf-life	5.41 ^d
Increased product prices	4.00 ^e
Reduced production costs	3.74 ^e

*7 - very important and 1 - not important. Note: items denoted with the same letter are not significantly different at $\alpha = 0.05$ (95 %) level based on Wilcoxon signed rank test

was most widely reported (Henson et al., 1999). The same was observed in the Turkish dairy industry where the increased customer confidence was reported as the main benefit in 64.3 % of surveyed companies (Karaman et al., 2012).

Increasing product quality was the main benefit of HACCP implementation in 82.1 % of the Turkish dairies (Karaman et al., 2012), in 82 % of UK food companies (Mensah and Julien, 2011), as well as for the majority of Indian (Marthi, 2001) and 18.2 % of Spanish food companies (Ramírez Vela and Martín Fernández, 2003). The Serbian dairy industry observed an increased quality of the products as the third most important benefit with the mean rank score of 6.22 (Table 8).

As previously observed (Jin et al., 2008) food enterprises with a fully operational HACCP system in place were more likely to regard HACCP system implementation as a way of improving their profit margins. Such findings could explain why Serbian dairies highly ranked (5.59) the benefit of an increased product sale. The mean rank score for the benefit of the increased ability to access new markets was also high (5.48) (Table 8) distinct to the UK results where the same benefit was claimed in less than 30 % of enterprises (Mensah and Julien, 2011).

The Greek analyses indicated the benefits from the HACCP operation by the improvement of microbial characteristics resulting that way in an increased product shelf-life (Semos and Kontogeorgos, 2007) while the same was observed in the UK dairy (Henson et al., 1999). Serbian dairy producers obviously shared the same perspective since the benefit of an increased product shelf life was ranked with the mean score of 5.41 (Table 8).

Conclusion

FSMS implementation in the Serbian dairy industry was not without difficulties. The major difficulties experienced were the attitude/motivation and the need to retrain both production and managerial staff. Major incentives for the implementation of HACCP were the increase in product safety and quality followed by the desire to comply to customer requirements, as well as the regulation system.

Although HACCP was designed to minimize product analyses, those costs were ranked as the most important ones. The present study confirmed the existence of “the competency gap” created by the difference in generic knowledge for manufacturing of the food products and the knowledge necessary to develop and implement FSMS, despite the relatively high educational level of Serbian dairy managers. The high importance of external consultant costs was just the consequence of the previous observation.

The benefits to the dairy industry in Serbia from HACCP as standalone food safety system or incorporated as a part of ISO 22000 were widespread and significant. In particular, Serbian dairy companies reported an increased product safety and quality, an increased customer confidence and better working discipline of the employees. The increased product sales and the ability to use HACCP as a legal instrument against complaints were equally important. However, this study revealed significant differences to the experience and results obtained from diverse European and other food industries.

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Evaluacija sustava upravljanja sigurnošću hrane u industriji mlijeka Srbije

Sažetak

U ovome radu ispitivani su motivi, troškovi, poteškoće i ostvarene koristi od uvođenja sustava upravljanja sigurnošću hrane u industriji mlijeka Srbije. Istraživanje je obuhvatilo 27 proizvođača mlijeka čiji je zajednički udio u ukupnoj nacionalnoj proizvodnji mlijeka i mliječnih proizvoda 65 %. Skoro dvije trećine ispitanih proizvođača (70,4 %) tvrdilo je da imaju potpuno operativan i certificiran HACCP sustav, dok je njih 29,6 % implementiralo HACCP ali ga nije i certificiralo. ISO 22000 uveden je i certificiran u 29,6 % kompanija, dok je samo 11,1 % isto učinilo za IFS standard. Najvažniji motiv za uvođenje sustava upravljanja sigurnošću hrane srpskih proizvođača

mlijeka bilo je povećanje razine sigurnosti i kvalitete proizvoda. Troškovi analiza sigurnosti proizvoda i angažmana eksternih konzultanata u početnoj fazi implementacije sustava bili su najznačajniji. Srpska industrija mlijeka nije bila pretjerano zabrinuta financijskim izdancima prvenstveno zbog činjenice da su gotovo svi preduvjetni programi već bili u funkciji kod skoro 100 % ispitanih proizvođača. Nedostatak specifičnih znanja i vještina neophodnih za uvođenje sustava upravljanja sigurnošću hrane bio je evidentan, usprkos činjenici da je 58,8 % srpskih upravljača proizvodnjom mlijeka fakultetski obrazovano. Naše istraživanje posebno skreće pažnju na činjenicu da se kao najveća prepreka za implementaciju HACCP-a pokazao negativan stav i nedostatak motivacije kod proizvodnih radnika. Najvažnija ostvarena korist jest povećana razina sigurnosti proizvoda od mlijeka koja je i ocijenjena najvišim rangom od 6,85. Povećanje povjerenja od strane potrošača i bolja radna disciplina zaposlenih u proizvodnji također su prepoznati kao značajan ostvareni dobitak od uvođenja/provođenja HACCP-a. Istraživanje je pokazalo da je razina HACCP implementacije visoka, bilo kao nezavisnog sustava ili inkorporiranog u ISO 22000, te da su od njega ostvarene koristi u industriji mlijeka Srbije veoma značajne.

Ključne riječi: upravljanje sigurnošću hrane, motivi, troškovi, poteškoće, koristi, industrija mlijeka

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