

Environmental issues revealed in certified bottling companies in the Republic of Serbia

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ARTICLE INFO

Article history:

Received 26 January 2012

Received in revised form

12 September 2012

Accepted 15 October 2012

Available online 26 October 2012

Keywords:

ISO 14001

Audit findings

Bottling companies

ABSTRACT

The aim of this study was to analyze findings found in environmental management systems implemented in nine certified bottling companies in the Republic of Serbia. During initial, surveillance and certificate renewal audits, a total of 158 nonconformities were issued. The results indicated that the majority of nonconformities found during initial audits were grouped in environmental elements (51.3%), in which legal requirements prevail. During surveillance audits, the majority of nonconformities were related to various environmental impacts (59.5%), such as management of hazardous materials, waste management, control of subcontractors and persons working for and on behalf of the companies. After three years of implementing requirements of ISO 14001, certificate renewal audits revealed nonconformities mainly related to environmental impacts (50%) in which hazardous materials and waste management prevail. Results obtained in this survey showed that as the environmental management system matures in the three years period, the distribution of nonconformities changes.

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1. Introduction

Nowadays, organizations are under growing pressure to manage and improve their environmental performance globally as a result of scientific and public evidence of consequences and environmental impacts of various productions and industries. Lawsuits, criminal penalties, and jail sentences also greatly concerned top management in many industries about the consequences of environmental violations or industrial accidents (Fryxell and Szeto, 2002). Increase of number of environmental management system (EMS) certificates world-wide and growing public concern caused that environmental management became one of companies' priorities, implying that they cannot survive on the global market without considering the environment (Kimitaka, 2010). Commitment to the environment has become a variable of growing importance within an increasingly competitive market including response to legal compliance and/or various market demands (Gomez and Rodriguez, 2011).

Setting up and running an EMS can provide significant benefits such as better regulatory compliance, effective use of available resources, increased sales opportunities, financial benefits and savings and improved image of a company. EMS based on ISO 14001

is developed to evaluate and improve the environmental performance of organizations, establish measurement, evaluate and monitor its processes, activities and services for all relevant environmental aspects, including legal compliance (ISO, 2004). Many organizations have implemented EMS in parallel with other management systems, most often quality management systems (QMS) (Bernardo et al., 2009). In the food industry, besides QMS, companies implement various food safety management systems based on ISO 22000, BRC Global Standard for Food Safety or other international standards. While QMS provides a more clear and obvious benefit for the company, the benefits related to EMS implementation are still uncertain and not so obvious.

Results presented by several authors indicated that the main reasons for implementing EMS in companies were to improve regulatory compliance, to increase market share and access to other markets and to enhance financial and social benefits as a response to customer/stakeholders requirements (Ahmet Murat, 2009; Alberto, 2001; Beltrán et al., 2010; Fryxell and Szeto, 2002; Gavronski et al., 2008; Lagodimos et al., 2007; Marimon et al., 2011; Poksinska et al., 2006; Zeng et al., 2005). However, the same results also showed that environmental performance and prevention of pollution were not among the major driving forces for EMS implementation.

By the end of 2010, at least 250,972 ISO 14001 certificates had been issued in 155 countries and economies. This number of ISO 14001 certificates represents the total number for all industries,

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since the standard is generic and applicable to all organizations, regardless of type, size and product provided. According to ISO survey, food industry is not among top five industrial sectors holding ISO 14001 certificates and covers 4% of all issued certificates (ISO, 2010).

Although some authors stated that ISO 14001 implementation and certification is a paper-driven process, considered as a marketing cue, without an impact on company's performance (Tzelepis et al., 2006), third party audits, performed in the aim of certification, can be used for organizational learning and continual improvement, since they provide audited organizations a unique opportunity to receive advices, new ideas and external assistance.

According to ISO 19011 and ISO 17021 standards, auditors should have generic knowledge of audit principles, management systems, applicable laws and regulations and standards they audit, as well as specific knowledge of the audited industry. Since the food industry is very complex and specific, there are a limited number of auditors that are competent for both environmental issues and this industry, needed for EMS certification. Due to that, quality of the audits varies, since certification concepts in agribusiness for EMS are still in the implementation phase and some auditors have lack of appropriate knowledge (Albersmeier et al., 2009; Beltrán et al., 2010; ISO, 2006, 2011). When applying the audit process, the efficiency of the audit strongly relies on the auditor's competence. It is of great importance the way the auditors interpret the standard, whether they adhere to these interpretations in granting certification and whether or not they go somewhat further to encourage the good practices codified in other ISO 14000 documents (Fryxell et al., 2004). For example, in the food industry, prerequisite programs encourage hygiene environmental behavior, and these good environmental practices should be known by the auditors

(Alimentarius, 2009; ISO, 2005). If not, ISO 14001 certification is a 'paper exercises' driven by commercial interests rather than a more genuine concern for the environment.

Reviewing literature available, authors identified three main groups of topics covering implementation and certification of ISO 14001 (Table 1). In the first group, named 'environmental performance, benefits and constraints in implementing EMS', the major topics analyzed were actual benefits of implementing EMS, improvements related to environmental performance and the main obstacles and constraints. The second group of topics, named 'motivating factors and business drivers for implementing EMS' covers reasons for ISO 14001 implementation. Since there is no research covering audits only for ISO 14001, third group named 'audits' covers integrated audits of various standards such as ISO 9001, ISO 14001 and other. Companies implement ISO 14001 joint with other management system standards, mainly ISO 9001 so this topic is in line with the objective of the paper. It is however important to note that all published papers analyzed the companies (mostly certified) and the research was based on their understanding of EMS. To our best of knowledge, there is no study showing and analyzing the nonconformities and other findings obtained during ISO 14001 third party audits in any specific food industry. Therefore the aim of this study was to take a step forward and look at implemented EMS from another view, in order to analyze findings revealed during EMS audits. Authors analyzed audit reports, issued by independent certification bodies from nine certified bottling companies in the Republic of Serbia in order to determine the distribution of nonconformities and opportunities for improvement in audited companies and to seek for possible correlation between maturity of an EMS and areas where findings were raised.

Table 1
Summary of studies linking various aspects of implemented EMS.

Authors	Topic covered	Sample
<i>Motivating factors and business drivers for implementing EMS</i>		
(Fryxell and Szeto, 2002)	Motivation for EMS	29 certified companies in Hong Kong
(Gavronski et al., 2008)	Motivations and benefits	63 Brazilian companies
(Kimitaka, 2010)	Business drivers for implementing EMS	155 countries
(Qi et al., 2011)	Stakeholders role in diffusion of EMS	31 province in China
(Babakri et al., 2003)	Critical factors for implementing EMS	177 US certified companies
(Fryxell et al., 2004)	Reputation of certification bodies	106 certified Chinese companies
<i>Environmental performance, benefits and constraints in implemented EMS</i>		
(Alberto, 2001)	Benefits of implemented EMS	1 food machinery manufacturer
(Beltrán et al., 2010)	Environmental performance	11 Spanish certified companies
(Turk, 2009)	EMS benefits	138 certified and non-certified Turkish construction companies
(Philippe, 2007)	Environmental performance	37 Canadian pulp and paper industry
(Gomez and Rodriguez, 2011)	Effects of EMS certification	56 certified vs.70 non-certified companies in Spain
(Heras-Saizarbitoria et al., 2011)	EMS certification and financial performance	268 certified vs. 7232 non-certified companies in Spain
(de Oliveira et al., 2010)	EMS benefits and constraints	69 Brazilian companies
(Ghisellini and Thurston, 2005)	EMS constraints	73 certified companies in US
(Cary and Roberts, 2011)	EMS limitations	27 farms in Australia
(Nawrocka and Parker, 2009)	EMS and environmental performance	23 studies
(Tan, 2005)	EMS benefits	38 certified Malaysian companies
(Comoglio and Botta, 2012)	Environmental performance	45 certified Italian automotive industry companies
<i>Audits</i>		
(Simon et al., 2011)	Integration of management system audits	4 Spanish companies
(Karapetrovic and Willborn, 2001)	System approach in auditing	Theoretical paper
(Bernardo et al., 2010)	Integration of internal and external audits	435 certified Spanish companies
(Kraus and Grosskopf, 2008)	Types of integrated audits	Theoretical paper

Summary compiled by the authors. Full citations for the studies' authors can be found in the references.

2. Materials and methods

By the end of 2010, according to ISO Survey and data from Serbian Chamber of Commerce, there were 318 ISO 14001 certificates in Serbia, out of which 20 were from the food industry (CoC, 2010; ISO, 2010). Nine bottling companies, which belong to this industry, were included in this study, where 44.4% were small companies (below 50 employees), 11.1% were medium sized companies (the number of employees was between 50 and 250) and 44.4% were large companies (the number of employees was above 250). Within the sample, six companies were bottlers of beverages and/or breweries, while three companies were bottlers of mineral water. All nine food bottling companies were holding ISO 14001 certificate. Due to the fact that the Accreditation Body of Serbia is not a member of the International Accreditation Forum, analyzed bottling companies obtained ISO 14001 certificates from two certification bodies, one holding ANAB accreditation (ANSI-ASQ National Accreditation Board) and the other holding UKAS accreditation (The United Kingdom Accreditation Service) (IAF, 2010). All sampled food companies were both ISO 9001 and HACCP/ISO 22000 certified.

The final outcome of any audit is a report. As outlined in international standards and guides, the audit report includes audit findings and conclusions (positive and negative) regarding the effectiveness of the management system with the requirements of the standard finding may be classified as a nonconformity and/or an opportunity for improvement (ISO, 2006, 2011). All nonconformities and opportunities for improvement rose against requirements of ISO 14001 standards found during auditing none bottling Serbian companies have been used for analysis in this paper.

A total of 25 audit reports were analyzed, which are divided according to audit type as reports from initial audits (IA), reports from surveillance audits (SV) and reports from certificate renewal (CR) audits. Audits were performed in the period from 2007 till 2011. IA consists of two stages. In the first stage, auditors assess the compliance of the documentation and readiness of the company and its premises covering evaluation of the location and premises, scope of the EMS and evaluation of internal audits and management review (ISO, 2006). In the second stage, auditors evaluate whether actual activities conform to the documented procedures and whether they are actively implemented (Poksinska et al., 2006). It covers conformity to the ISO 14001 standard including environmental performance monitoring, measuring, reporting and reviewing against key performance objectives and targets, legal compliance, operational control, management responsibility, internal auditing and management review (ISO, 2006).

Upon successful completion of this audit, a three-year surveillance program is developed to monitor the EMS on a regular basis and to consider changes within the management system and achieved improvements. SV cover internal audits, management review, follow up activities from previous audits, handling of complaints, effectiveness of the system, progress toward continual improvement, operational control, review of any changes and use of mark/logo of certification and accreditation body (ISO, 2006). The audit that is taken three years after certification of EMS (based on ISO 14001), for the purpose of recertification, is referred to as CR.

Findings revealed during ISO 14001 audits and analyzed in this study have been grouped in three categories. First category determined as management elements covers requirements generic for each management system such as internal auditing, management reviews, environmental objectives and targets, corrective and preventive actions, documentation and records control. Second category named environmental elements covers requirements specific to ISO 14001 such as environmental aspects, legal requirements and compliance, communication with interested

parties, environmental training, emergency response, monitoring and measurement of environmental performance. Third category consists of findings related to environmental impacts of the companies. Regardless of the methodology for identification of aspects and determination of significant impacts, in all companies environmental impacts included waste water, waste management, management of hazardous materials, soil contamination, use of various types of subcontractors within the premises, fleet management covering all types of transportation services and use of ozone depletion substances mainly for cooling the beverages. Apart from these impacts, usage of natural resources (mainly water) and consumption of energy were also identified but no findings were revealed in this area, and therefore they were not analyzed in this study.

Regarding the auditors that were involved in auditing bottling companies, in total six different auditors have been involved, two of them having both environmental and food industry background and four of them with only environmental background. In all audits performed in bottling companies, team leaders were food experienced environmental auditors.

Results were processed using Microsoft Office 2007.

3. Results and discussion

3.1. Nonconformities by audit type

The obtained EMS audit reports indicated that the total number of 158 nonconformities had been issued in nine bottling companies in the Republic of Serbia during four years period from 2007 till 2011. Nonconformities revealed in IA showed that the majority are grouped within environmental legal requirements, followed by management elements (Table 2). Other EMS elements participate in less than 10% of each. In most cases, bottling companies did not follow the latest changes in national legislation due to the fact that in the last four years Serbian Ministry of Environment, Mining and Spatial Planning put into force 11 new/modified laws and over 70 regulations covering environmental protection, waste management, water and waste water, chemicals, ionizing and non-ionizing radiation, noise and air quality. The reason for this great number of new regulations is the process of harmonization of the Republic of Serbia with the European Union. Since the ISO 14001 standard

Table 2
EMS nonconformities by audit type.

Nonconformities	IA ^a	SV ^b	CR ^c	Total	%
Management elements	7	9	5	21	13.3
Environmental elements	20	23	15	58	36.7
Aspects	2	1	3	6	3.8
Environmental legal requirements and compliance	10	8	0	18	11.4
Communication	1	0	0	1	0.6
Environmental training	1	3	2	6	3.8
Emergency response	3	3	7	13	8.2
Monitoring and measurements of environmental performance	3	8	3	14	8.9
Environmental impact	12	47	20	79	50.0
Waste management	3	13	5	21	13.3
Waste water	3	7	2	12	7.6
Hazardous materials management	3	15	9	27	17.1
Soil contamination	0	0	4	4	2.5
(Sub)contractors	2	9	0	11	7.0
Fleet management	0	2	0	2	1.3
Ozone depletion	1	1	0	2	1.3
	39	79	40	158	100.0

Bold values are semi-values and are useful for showing data.

^a IA, initial audit.

^b SV, surveillance audit.

^c CR, certificate renewal audit.

requires identification and access to applicable legislation including their relation to environmental aspects, this nonconformity was often identified in audited bottling companies. In relation to this nonconformity, periodical evaluation of legal compliance, as another ISO 14001 requirement, was often incomplete and inadequate. In all companies, evaluation of legal compliance was an input to their management reviews.

During SV the majority of nonconformities were related to management of hazardous materials waste management, control of subcontractors and persons working for and on behalf of the companies, as well as legal issues and monitoring and measurement of environmental performance (Table 2). Typical nonconformities regarding management of hazardous materials were inadequate storage of chemicals and technical gases, inadequate labeling of stored chemicals, lack of secondary containers, missing or obsolete Material Safety Data Sheets (MSDSs) including lack of control measures to ensure safe and environmental friendly use of these chemicals. Findings related to waste management were bad practices in segregation of various types of wastes and inadequate landfills, including poor implementation of national waste strategy that consists of five steps: reduce, reuse, recycle, recovery, and disposal (Serbia, 2010). Along with hazardous materials and waste management, nonconformities related to waste water indicated that companies had problems with monitoring of environmental performance of waste water quality when results were out of specified limits or frequency of monitoring was not adequate. Extent of proposed corrective actions went from fine tuning of the waste water treatment plant to root cause analysis within technological process and further analysis of characteristics of sludge.

The results indicated that some companies did not monitor their environmental performance indicators which were related to their significant aspects (such as energy usage, water consumption and generated amounts of waste). Companies usually monitor only legally required indicators such as the amount of hazardous materials in use and quarterly analysis of waste water quality. In other occasions, the results of monitoring were imprecise, or based on assumptions not measurements. In some companies, as a result of inadequate segregation of waste, there were no data for any type of waste, as well as for total waste. Finally, some companies had annual data with poor monthly reporting on environmental performance. Similar experience has been obtained by Philippe, showing that adoption of the ISO 14001 does not necessarily lead to significant impact on the industry's environmental performance, or it may lead to limited improvements (Philippe, 2007). On the other side, some authors state that benefits in certified companies related to environmental requirements are mostly focused on improving relations with subcontractors' and all persons working for and on behalf of the organization, as well as more accurate monitoring of environmental performance (Ahmet Murat, 2009; Beltrán et al., 2010; Fryxell and Szeto, 2002).

After three years of implementing requirements of ISO 14001, during CR audits, nonconformities related to management of hazardous materials and waste management again prevailed, along with emergency response (Table 2). Emergency response and preparedness were related to the lack of identification of potential emergency situations and periodical testing of implemented emergency procedures. Most companies identified natural disasters as the only potential emergency situations (earthquakes, floods) including fire, as there is a legal requirement for each company to develop a fire emergency plan. Some companies were not fully aware of all of their on-site hazards (measures to be taken in the event of spillages or accidental releases of flammable liquids, storage tanks and compressed gases, operational failures on the waste water treatment plant, and other related to environmental aspects). Also, periodical testing of emergency plans were poor,

with no actions to minimize environmental damages in the case of emergency situation.

Regarding three categories of nonconformities, namely management elements, environmental elements and environmental impacts, during IA environmental elements were the greatest, followed by environmental impacts (Fig. 1). According to the obtained results, it seems that with the maturation of an EMS, during SV and CR audits, the environmental impacts prevailed over environmental and management elements in selected food companies.

These results are in accordance with the results obtained in the Spanish survey of ISO 14001 certified companies which showed that nonconformities related to environmental impacts were above 50% in total number of all nonconformities (Gomez and Rodriguez, 2011).

Except during IA, management elements participate with less than 15% of all nonconformities. Since all companies were ISO 9001 and HACCP/FSMS certified, it is surprising that nonconformities still occur in the elements common to all management systems. This can drive to a conclusion that management commitment is poor, no matter which management standard is implemented. Main obstacles to ISO 9001 implementation and certification are in the top management (Withers and Ebrahimpour, 2000), and therefore the lack of management commitment, inadequate understanding of the management requirements and seeking for certification instead of striving to implement a good system are the most common causes for these nonconformities.

As already reported as several authors, problems and main obstacles identified in the implementation of ISO 14001 were lack of qualified personnel and experts, bad identification of environmental aspects and impacts, lack of subcontractor cooperation, lack of environmental performance development and bad documentation (Babakri et al., 2003; Shen and Tam, 2002). Results presented in our study indicated that when an EMS has just been implemented, during IA, the focus of nonconformities was on environmental elements while, as EMS matures, problems mostly occur within environmental impacts.

Competence and awareness is one of ISO 14001 requirements, and depending on the awareness of the company, Gomez and Rodriguez identified two types of companies (Gomez and Rodriguez, 2011). First type with an active approach, develop competence and increase employee awareness only to fulfill legal requirements. Second types of companies, the ones with proactive approach, are those which consider their environmental performance in all decision-making processes, in order to increase their

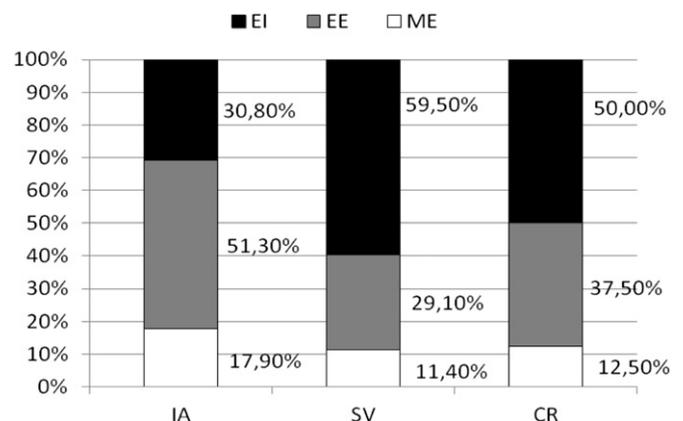


Fig. 1. Distribution of EMS nonconformities by audit type. ME, management elements; EE, environmental elements; EI, environmental impacts; IA, initial audits; SV, surveillance audits; CR, certificate renewal.

share in markets for environmentally friendly products. If a reactive strategy is only intended to comply with the law, it will solve the environmental problem in the short run, but it will not be sufficient to improve the company's competitive position. Overview of the number of nonconformities related to the legal issues showed reduction in audited bottling companies, being 25% during IA, 10% during CV, while no legal nonconformity was found three years after certification (CR). This can be an indication why legal issues have been revealed as one of the most significant findings in IA. Over time companies transform themselves from active to proactive, in a three years period, so legal compliance becomes a driver for environmental improvements.

3.2. Nonconformities by the scope of the production

Depending on the particular products produced, food processing is energy consuming and may result in large quantities of solid and liquid industrial wastes. Although mainly not toxic, these wastes are heavily organically loaded and, if not effectively managed, may cause serious environmental concerns (Lagodimos et al., 2007). Results obtained in this study indicated that, regardless of the type of production (beverages or water production), the majority of nonconformities were related to environmental impacts and environmental elements (Table 3). Nonconformities issued in beverage bottlers were mainly related to environmental impacts (54.3%), with management of hazardous materials, waste management and legal issues being the greatest. In water bottling companies, the nonconformities related to environmental elements and environmental impacts were represented with 37.7 and 38.1%, respectively, with waste management and managing subcontractors identified as the major problems (Table 3).

3.3. Nonconformities related to the size of the companies

Distribution of nonconformities depending on the size is presented in Table 4. In small and medium sized bottling companies, environmental impacts and environmental elements have similar share (over 40% each). The major problems were related to management of hazardous materials and waste management. Also nonconformities within management elements in small and medium sized companies have been revealed. These food companies are faced with the challenge that the complexity of environmental and legal requirements increases while their organizational

Table 3
EMS nonconformities by scope.

Nonconformities	Beverages	%	Water	%
Management elements	10	8.6	11	26.2
Environmental elements	43	37.1	15	35.7
Aspects	3	2.6	3	7.1
Environmental legal requirements and compliance	15	12.9	3	7.1
Communication	0	0.0	1	2.4
Environmental training	6	5.2	0	0.0
Emergency response	10	8.6	3	7.1
Monitoring and measurements of environmental performance	9	7.8	5	11.9
Environmental impact	63	54.3	16	38.1
Waste management	15	12.9	6	14.3
Waste water	12	10.3	0	0.0
Hazardous materials management	23	19.8	4	9.5
Soil contamination	4	3.4	0	0.0
(Sub)contractors	5	4.3	6	14.3
Fleet management	2	1.7	0	0.0
Ozone depletion	2	1.7	0	0.0
	116	100.0	42	100.0

Bold values are semi-values and are useful for showing data.

Table 4
EMS nonconformities by company size.

Nonconformities	Small/ medium	%	Big	%
Management elements	11	16.2	10	11.1
Environmental elements	28	41.2	30	33.3
Aspects	3	4.41	3	3.33
Environmental legal requirements and compliance	11	16.18	7	7.78
Communication	1	1.47	0	0.00
Environmental training	1	1.47	5	5.56
Emergency response	6	8.82	7	7.78
Monitoring and measurements of environmental performance	6	8.82	8	8.89
Environmental impact	29	42.6	50	55.6
Waste management	7	10.29	14	15.56
Waste water	3	4.41	9	10.00
Hazardous materials management	12	17.65	15	16.67
Soil contamination	0	0.00	4	4.44
(Sub)contractors	6	8.82	5	5.56
Fleet management	0	0.00	2	2.22
Ozone depletion	1	1.47	1	1.11
	11	100.00	10	100.00

Bold values are semi-values and are useful for showing data.

knowledge decreases and time for fulfilling the requirements shortens. On the other side, in big companies the majority of findings are within environmental impacts (over 50%). Findings that participate in more than 10% are all within the category of environmental impacts – managing hazardous materials, waste management and waste water.

3.4. Opportunities for improvement in audited companies

Besides nonconformities, auditors may issue opportunities for improvement, highlighting something which the company should have in mind and where it should direct their efforts in further improvement of the EMS system (ISO, 2002). Table 5 shows opportunities given by auditors depending on the type of the audit. Waste management and managing subcontractors generated the most opportunities for improvement with more than 10% each. It is interesting that distribution of opportunities for improvements related to three categories (environmental impacts – 50%, environmental elements – 36.7% and management elements – 13.3%) is similar as distribution of nonconformities related the these categories as given in Table 2. Further calculation of opportunities for improvement showed that the average number of these findings in EMS audits was 0.5 during IA, 0.8 during SV and 2.3 during CR meaning that as an EMS matures, new areas for improvement appeared.

3.5. Correlation between nonconformities in audited companies

In order to analyze correlation between nonconformities, Pearson's correlation coefficient was calculated, significant at the 0.05 level (Table 6). Eleven categories were chosen – eight covering environmental categories where the majority of nonconformities were grouped and three covering the types of audits. The results show that there is a strong correlation between nonconformities related to legal issues and the fact that they were raised during IA (0.759). This can drive to a conclusion that companies did not understand the importance of legal compliance since in other two management standards that companies implemented (QMS and HACCP/FSMS); legal compliance is not as strongly emphasized as in EMS. Within SV the highest correlation was found for waste water (0.808), followed by waste management (0.748), hazardous materials (0.720) and monitoring (0.718). Due to the fact that the purpose of SV is the evaluation of the effectiveness of EMS

Table 5
Correlation between nonconformities in audited companies. The categories chosen are as follows: number of nonconformities revealed during initial audits/NCs in IA/, number of nonconformities revealed during surveillance audits/NCs in SV/, number of nonconformities revealed during certificate renewal audits/NCs in CR/, nonconformities related to management elements/Management/, nonconformities related to legal issues/Legal/, nonconformities related to waste management/Waste/, nonconformities related to waste water/Waste water/, nonconformities related to hazardous materials/Haz. Materials/, nonconformities related to subcontractors/(Sub)contractors/, nonconformities related to emergency response/Emergency/and nonconformities related to monitoring of environmental performance and calibration/Monitoring/.

	NCs in IA	NCs in SV	NCs in CR	Management	Legal	Waste	Waste water	Haz. materials	(Sub)contractors	Emergency	Monitoring
Management	-0.245	0.116	0.031	1.000							
Legal	0.759	0.239	-0.354	-0.387	1.000						
Waste	-0.390	0.748	0.538	0.203	0.079	1.000					
Waste water	0.135	0.808	0.031	-0.264	0.720	0.480	1.000				
Haz. materials	-0.139	0.720	0.287	-0.375	0.439	0.467	0.814	1.000			
(Sub)contractors	0.056	-0.090	0.232	0.552	-0.166	-0.108	-0.296	-0.460	1.000		
Emergency	0.305	0.641	0.261	-0.200	0.621	0.425	0.766	0.601	-0.066	1.000	
Monitoring	-0.142	0.718	0.304	0.156	0.242	0.748	0.487	0.438	0.166	0.474	1.000

Critical values for Pearson's correlation coefficient for this size of sample is 0.667 for two-tailed test with $p = 0.05$ level of significance.

Table 6
EMS opportunities for improvement.

OFIs	IA	SV	CR	Total	[%]
Management elements	0	3	1	4	13.3
Environmental elements	1	4	6	11	36.7
Aspects	0	1	0	1	3.3
Environmental legal requirements and compliance	0	2	1	3	10.0
Communication	0	0	1	1	3.3
Environmental training	0	0	1	1	3.3
Emergency response	1	0	2	3	10.0
Monitoring and measurements of environmental performance	0	1	1	2	6.7
Environmental impact	1	5	9	15	50.0
Waste management	0	3	2	5	16.7
Waste water	1	0	1	2	6.7
Hazardous materials management	0	0	2	2	6.7
Soil contamination	0	0	0	0	0.0
(Sub)contractors	0	2	2	4	13.3
Fleet management	0	0	2	2	6.7
Ozone depletion	0	0	0	0	0.0
	30			100.0	

Bold values are semi-values and are useful for showing data.

including progress toward continual improvement and operational control, this proves that time is needed for management system to mature in order to have procedures fully in place. There is a correlation between the findings related to legal issues and the ones related to waste water (0.720), raising a conclusion that waste water treatment has an important environmental concern with the industry of bottling beverages and legally required analyses often show minor deviation in the quality of waste water. Waste water has two strong correlations, with hazardous materials (0.814), and with emergency response (0.766). Finally there is a correlation between monitoring of EMS indicators and waste management (0.748).

4. Conclusion

Results obtained in this study showed that as the environmental management system matures in the three years period, the distribution of nonconformities changes. During IA, at the time when the system has just been implemented, majority of nonconformities were related to environmental elements due to the fact that the system has not been established properly. The main reason is lack of competence of both workers and external expert, especially due to the fact that quality of consulting services in the Republic of Serbia is not on a high level.

During SV, the majority of nonconformities were within the environmental impacts category since the role of SV was to check

implementation of environmental practice. Finally, during CR when auditors audit the entire EMS again, beside environmental impacts, a great number of nonconformities were found within environmental elements.

Authors believe that future research should focus on the correlation between maturity of EMS, distributions of findings and identification of possible patterns related to other specific food industries.

It is very hard to expect a pattern in findings in ISO 14001 audits over time due to several factors such as competence of different auditors and their opinion on certain matters, clarification in auditing procedures prepared by certification bodies, increase of environmental knowledge, improvement of good environmental practice, organizational or personal changes in companies that may occur in three years and changes in legislation.

A wider and more complex research, with a bigger sample from the entire food industry coming from various countries and different environmental practices could help all interested parties in the audit process. If such a pattern is typical for some or all food industries, employees directly involved in EMS matters could plan specific awareness training to improve their environmental performance and good environmental practice. This knowledge can direct managers on how to develop and improve their EMS over time. It could help auditors to increase their knowledge on what issue they can expect in a certain industry. Finally it can encourage certification bodies to organize specific workshops for calibrating auditors and developing their skills when auditing food industry.

References

- Ahmet Murat, T., 2009. The benefits associated with ISO 14001 certification for construction firms: Turkish case. *J. Cleaner Prod.* 17, 559–569.
- Albersmeier, F., Schulze, H., Jahn, G., Spiller, A., 2009. The reliability of third-party certification in the food chain: from checklists to risk-oriented auditing. *Food Control* 20, 927–935.
- Alberto, P., 2001. Developing a methodology for analysis of benefits and shortcomings of ISO 14001 registration: lessons from experience of a large machinery manufacturer. *J. Cleaner Prod.* 9, 351–364.
- Alimentarius, C., 2009. *Food Hygiene – Basic Texts*. World Health Organisation & Food and Agriculture Organization of the United Nations, Rome.
- Babakri, K.A., Bennett, R.A., Franchetti, M., 2003. Critical factors for implementing ISO 14001 standard in United States industrial companies. *J. Cleaner Prod.* 11, 749–752.
- Beltrán, J., Muñozuri, J., Rivas, M., González, C., 2010. Metrological management evaluation based on ISO10012: an empirical study in ISO-14001-certified Spanish companies. *Energy* 35, 140–147.
- Bernardo, M., Casadesus, M., Karapetrovic, S., Heras, I., 2009. How integrated are environmental, quality and other standardized management systems? An empirical study. *J. Cleaner Prod.* 17, 742–750.
- Bernardo, M., Casadesus, M., Karapetrovic, S., Heras, I., 2010. An empirical study on the integration of management system audits. *J. Cleaner Prod.* 18, 486–495.
- Cary, J., Roberts, A., 2011. The limitations of environmental management systems in Australian agriculture. *J. Environ. Manage.* 92, 878–885.

- CoC, 2010. Database of Certified Organisations. Serbian Chamber of Commerce.
- Comoglio, C., Botta, S., 2012. The use of indicators and the role of environmental management systems for environmental performances improvement: a survey on ISO 14001 certified companies in the automotive sector. *J. Cleaner Prod.* 20, 92–102.
- de Oliveira, O.J., Serra, J.R., Salgado, M.H., 2010. Does ISO 14001 work in Brazil? *J. Cleaner Prod.* 18, 1797–1806.
- Fryxell, G.E., Chung, S.S., Lo, C.W.H., 2004. Does the selection of ISO 14001 registrars matter? Registrar reputation and environmental policy statements in China. *J. Environ. Manage.* 71, 45–57.
- Fryxell, G.E., Szeto, A., 2002. The influence of motivations for seeking ISO 14001 certification: an empirical study of ISO 14001 certified facilities in Hong Kong. *J. Environ. Manage.* 65, 223–238.
- Gavronski, I., Ferrer, G., Paiva, E.L., 2008. ISO 14001 certification in Brazil: motivations and benefits. *J. Cleaner Prod.* 16, 87–94.
- Ghisellini, A., Thurston, D.L., 2005. Decision traps in ISO 14001 implementation process: case study results from Illinois certified companies. *J. Cleaner Prod.* 13, 763–777.
- Gomez, A., Rodriguez, M.A., 2011. The effect of ISO 14001 certification on toxic emissions: an analysis of industrial facilities in the north of Spain. *J. Cleaner Prod.* 19, 1091–1095.
- Heras-Saizarbitoria, I., Molina-Azorin, J.F., Dick, G.P.M., 2011. ISO 14001 certification and financial performance: selection-effect versus treatment-effect. *J. Cleaner Prod.* 19, 1–12.
- IAF, 2010. IAF MLA Group Members. IAF.
- ISO, 2002. ISO 19011:2002 – Guidelines for Quality and/or Environmental Management Systems Auditing. International Organization for Standardization.
- ISO, 2004. ISO 14001:2004 Environmental Management Systems – Requirements with Guidance for Use. International Organization for Standardization.
- ISO, 2005. ISO 22000:2005 Food Safety Management Systems – Requirements for Any Organization in the Food Chain. International Organization for Standardization.
- ISO, 2006. ISO 17021:2006 Conformity Assessment – Requirements for Bodies Providing Audit and Certification of Management Systems. International Organization for Standardization.
- ISO, 2010. The ISO Survey of Certifications 2010.
- ISO, 2011. ISO 19011:2011 – Guidelines for Auditing Management Systems. International Organization for Standardization.
- Karapetrovic, S., Willborn, W., 2001. Audit system: concepts and practices. *Total Qual. Manage.* 12, 13–28.
- Kimitaka, N., 2010. Demand for ISO 14001 adoption in the global supply chain: an empirical analysis focusing on environmentally conscious markets. *Resour. Energy Econ.* 32, 395–407.
- Kraus, J.L., Grosskopf, J., 2008. Auditing integrated management systems: considerations and practice tips. *Environ. Qual. Manage.* 18, 7–16.
- Lagodimos, A.G., Chountalas, P.T., Chatzi, K., 2007. The state of ISO 14001 certification in Greece. *J. Cleaner Prod.* 15, 1743–1754.
- Marimon, F., Llach, J., Bernardo, M., 2011. Comparative analysis of diffusion of the ISO 14001 standard by sector of activity. *J. Cleaner Prod.* 19, 1734–1744.
- Nawrocka, D., Parker, T., 2009. Finding the connection: environmental management systems and environmental performance. *J. Cleaner Prod.* 17, 601–607.
- Philippe, B., 2007. ISO 14001 certification and environmental performance in Quebec's pulp and paper industry. *J. Environ. Econ. Manage.* 53, 291–306.
- Poksinska, B., Dahlgaard, J.J., Eklund, J.A.E., 2006. From compliance to value-added auditing – experiences from Swedish ISO 9001: 2000 certified organisations. *Total Qual. Manage. Bus. Excell.* 17, 879–892.
- Qj, G.Y., Zeng, S.X., Tam, C.M., Yin, H.T., Wu, J.F., Dai, Z.H., 2011. Diffusion of ISO 14001 environmental management systems in China: rethinking on stakeholders' roles. *J. Cleaner Prod.* 19, 1250–1256.
- Serbia, 2010. Waste Management Law. Official Gazette of the Republic of Serbia.
- Shen, L.Y., Tam, V.W.Y., 2002. Implementation of environmental management in the Hong Kong construction industry. *Int. J. Project Manage.* 20, 535–543.
- Simon, A., Bernardo, M., Karapetrovic, S., Casadesús, M., 2011. Integration of standardized environmental and quality management systems audits. *J. Cleaner Prod.* 19, 2057–2065.
- Tan, L.P., 2005. Implementing ISO 14001: is it beneficial for firms in newly industrialized Malaysia? *J. Cleaner Prod.* 13, 397–404.
- Turk, A.M., 2009. The benefits associated with ISO 14001 certification for construction firms: Turkish case. *J. Cleaner Prod.* 17, 559–569.
- Tzelepis, D., Tsekouras, K., Skuras, D., Dimara, E., 2006. The effects of ISO 9001 on firms' productive efficiency. *Int. J. Oper. Prod. Man.* 26, 1146–1165.
- Withers, B., Ebrahimpour, M., 2000. Does ISO 9000 certification affect the dimensions of quality used for competitive advantage? *Eur. Manage. J.* 18, 431–443.
- Zeng, S.X., Tam, C.M., Tam, V.W.Y., Deng, Z.M., 2005. Towards implementation of ISO 14001 environmental management systems in selected industries in China. *J. Cleaner Prod.* 13, 645–656.