INDICATORS OF EFFICIENCY OF MANAGEMENT SYSTEM IN FOOD INDUSTRY COMPANIES

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Abstract: During the implementation of management standards, it is necessary to monitor a large number of parameters. If the company decided to monitor all parameters, the implementation of the standard would be very expensive. In this work, the goal is to propose a smaller number of specific parameters (indicators of efficiency), which indicate key changes in the management system. In the course of the research, a survey was conducted in food sector companies in four Balkan countries (Bosnia and Herzegovina, Serbia, North Macedonia and Montenegro), in which the surveyed companies were asked to state whether they apply (and to what extent) indicators of the effectiveness of the health management system and safety at work and indicators of efficiency of the environmental protection management system. Applying the Kruskal Walliss test, it was examined whether the average values of the response functions of company representatives regarding the application of efficiency indicators differ statistically significantly in relation to the country in which the company operates. When analyzing the responses of companies from all countries included in this survey, it can be seen that as indicators of the effectiveness of the occupational health and safety management system, companies most often monitor the number of incidents at work (86%), lost time due to injuries (76%) and the number of workers with occupational diseases (71%), and very rarely follows the number of deaths (12%) and the number of obese people among employees (22%). As indicators of the environmental protection management system, surveyed companies most often monitor the degree of reduction in electricity consumption (88%) and the index of greenhouse gas emissions (37%), and rarely monitor the degree of increase in green areas (26%). Based on the Kruskal Walliss test, it can be concluded that the country in which the company operates had no statistically significant influence on the distribution of responses regarding the application of the analyzed groups of efficiency indicators.

Keywords: indicators of efficiency, environmental protection management system, occupational health and safety management system, food sector, Balkan countries

Introduction

During the implementation of management standards (QMS, WMS, FSMS, OHSAS, IMS) it is necessary to monitor a large number of parameters. If the company decided to monitor all parameters, the application of the standard would be very expensive. That is why companies decide to monitor a smaller number of specific parameters that indicate the most important changes. Those parameters are

designated as key indicators. During the application of different standards, the same efficiency indicators can be used. Using these indicators is very important for the success of any organization. The team for the implementation of the management system in the organization based on the knowledge and experience of the team members, as well as information from the References, evaluates the key indicators [1]. Evaluation of the success of the organization, according to Mohammadfam et al. [2] can be established based on the comparison of certain criteria and indicators related to occupational health and safety management practices. Organizations dealing with food monitor the efficiency indicators and based on that they evaluate the efficiency of the system. Food incidents can have consequences for human health and the environment, and create financial problems for the organization [3].

Frankish et al. [3] used 71 indicators in their research on the safety of apples during storage. These indicators are divided into several groups depending on the factors for which they will be used for analysis: product (5 indicators), process (3 indicators), organization (7 indicators), characteristics of the environment in the supply chain (8 indicators), preventive measures (12 indicators), intervention processes (1 indicator), monitoring system (8 indicators), basic safety control activities (8 indicators), basic activities of ensuring system requirements, validation, verification, documentation and record keeping (9 indicators) external and internal performance indicators (a total of 8) for evaluating the effectiveness of food safety [4]. Frankish et al. [3] developed a tool to monitor FSMS effectiveness, which includes various indicators along the fresh fruit supply chain. Several researchers were involved in the development of indicators in the field of occupational safety [5-9]. During the investigation of the impact of the production process on the environment, various indicators were used: productivity [10], green TFP growth at plant level [11], green TFP [12] and financial performance [13].

There is a need for tools with which companies in the food sector (entities dealing with food) will check the effectiveness of their EMS and OHSAS implementation. For this purpose, it is necessary to select a certain number of indicators. In this paper, the authors want to determine the efficiency indicators that are most often applied by companies from the food sector in four Balkan countries (Bosnia and Herzegovina, Serbia, North Macedonia and Montenegro) and whether the country in which the company operates has an influence on the choice and application of system efficiency indicators management. The authors put forward two hypotheses, which they want to examine:

H_{01}: Distribution F(P25) of the average values of the responses on the use of the indicator of the effectiveness of the health and safety management system at work is the same in relation to the country in which the company operates.

H_{02}: Distribution F(P26) of the average values of the answers about the use of indicators of the efficiency of the environmental protection management system is the same in relation to the country in which the company operates.

Material and methods work

The results presented in this paper are part of extensive research [14] conducted in four countries in the Balkans (Bosnia and Herzegovina, Serbia, North Macedonia and Montenegro). During the research, a survey was conducted in companies from the food sector in the mentioned countries. The questions from the survey questionnaire were answered by owners or representatives of key management personnel. For the purposes of the research, a survey questionnaire was designed, within which the questions were classified into several groups [14-18]. Krombach's alpha coefficient was used to examine reliability and internal agreement for this sample. During 2021, the questionnaire was distributed to targeted respondents (149 companies from the food industry sector in Bosnia and Herzegovina, Serbia, North Macedonia and Montenegro). The distribution process was via email with a digital link for users to complete the survey questionnaire (Microsoft Forms). Respondents were asked to objectively answer the questions. The completed questionnaires were returned by the companies to the research team. After the quality assessment, the answers of 92 companies were accepted (Bosnia and Herzegovina 42, Serbia 30, North Macedonia 14 and Montenegro 6). This corresponds to a response rate of 61.74% (Table 1).

Table 1. Number of companies that participated in the survey

The country where the company operates				
BIH	SRB	MKD	MNE	Total
42 (45,7%)*	30 (32,6%)*	14 (15,2%)*	6 (6,5%)*	92

* - number of companies (share in the total number of surveyed companies, %)

The non-parametric Kruskal-Wallis test/Two-tailed test was used during the statistical processing of the survey results. The responses were analyzed using the Statistical Package for Social Sciences computer software (IBM SPSS 26.0).

Results and Discussion

The effectiveness of the application of management standards is monitored using indicators (indicators) of the effectiveness of the management system. Certain questions in the survey questionnaire were related to the indicators of the efficiency of the health and safety management system at work and the efficiency of the environmental protection system. The answers given by representatives of companies from all four countries are shown in Figures 1 and 2.

Figure 1 shows the responses of the representatives of the surveyed companies regarding the application of indicators of the efficiency of the health and safety management system at work. During the analysis, the responses of the companies were followed in which they confirmed/denied that they apply the following indicators: *Number of incidents*, *Number of deaths*, *Lost time due to injuries*, *Number of identified safety hazards*, *Number of obese persons among employees*, *Number of workers with occupational diseases*. In their answers, the surveyed companies responded with *YES* or *NO*, depending on whether they use a certain indicator in

practice. Of the six indicators offered, companies operating in BIH confirmed that they most often monitor: *Number of incidents* (81%), *Number of identified safety hazards* (74%), *Number of workers with occupational diseases* (60%), etc. Companies operating in SRB confirmed that from this group of indicators they most often monitor: *Number of incidents* (87%), *Number of identified safety hazards* (77%), *Lost time due to injuries* (83%), *Number of workers with occupational diseases* (73%) etc. Companies operating in MKD confirmed that from this group of indicators they most often monitor: *Number of incidents* (93%), *Lost time due to injuries* (86%), *Number of workers with occupational diseases* (86%), *Number of identified safety hazards* (79%) etc. Finally, companies operating in MNEs confirmed that from this group of indicators they most often monitor: *Number of incidents* (100%), *Number of workers with occupational diseases* (100%), *Lost time due to injuries* (67%), *Number of identified safety hazards* (67%) etc. When the answers of all the companies included in this survey are analyzed, it can be seen that of the offered indicators, the companies most often monitor: *Number of incidents at work* (86%), *Lost time due to injuries* (76%) and *Number of workers with occupational diseases* (71%) , and are very rarely followed by the *number of deaths* (12%) and the *number of obese persons among employees* (22%).
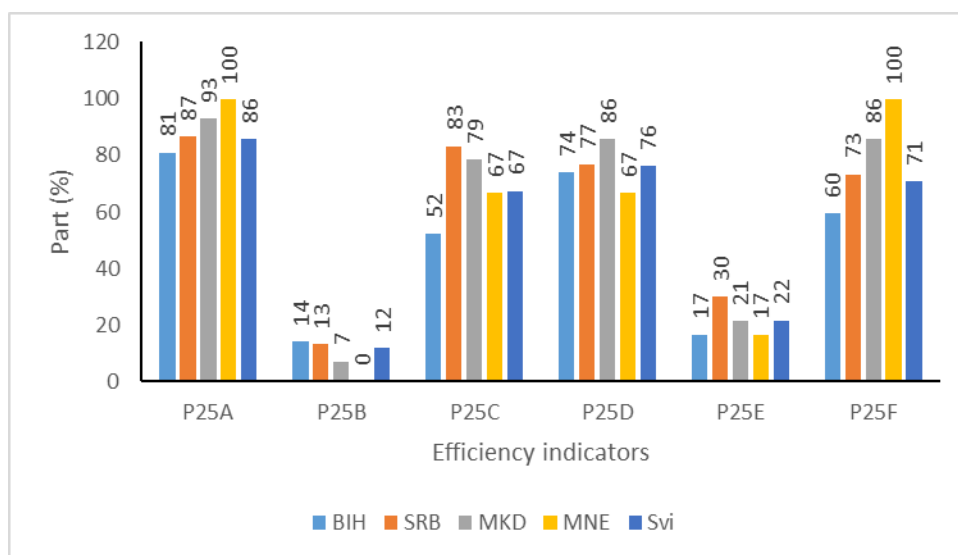

Figure 1. Overview of indicators of the effectiveness of the health and safety management system at work (N=92). The results show the share of companies in relation to the number of surveyed companies from each country (%)
P25A - Number of incidents, P25B - Number of deaths, P25C - Lost time due to injuries, P25D - Number of identified safety hazards, P25E - Number of obese persons among employees, P25F - Number of workers with occupational diseases

The average values of the company's response regarding the application of the observed indicators for evaluating the effectiveness of the occupational health and safety management system are represented by the function:

$$F(P25) = Mean\ (P25A, P25B, P25C, P25D, P25E, P25F).$$

Descriptive values of the function F(P25) are shown in table 2.

Table 2. Descriptive values of the function F(P25) of the average values of the responses on the use of indicators of the effectiveness of the health and safety management system at work in relation to the country of origin

The country in which the undertaking operates	Number (N)	Average value	SD	GOPV	95% Confidence interval		Min.	Max.
					Lower limit	Lower limit		
Bosnia and Herzegovina	42	1,49	0,25	0,0391	1,41	1,57	1,00	1,83
Serbia	30	1,60	0,22	0,0411	1,52	1,69	1,00	2,00
North Macedonia	14	1,62	0,19	0,0507	1,51	1,73	1,17	1,83
Montenegro	6	1,58	0,17	0,0714	1,39	1,77	1,33	1,83
Total	92	1,56	0,23	0,0245	1,51	1,60	1,00	2,00

SD - Standard deviation; GOPV - Error of estimation of average value

Applying the Kruskal Walliss test, it was examined whether the average values of the response functions of company representatives regarding the application of indicators of the effectiveness of the health and safety management system at work differ statistically significantly in relation to the country where the company operates. The results of applying the Kruskal Wollis test are given in table 3.

Table 3. Results of the Kruskal-Wallis test

	The country where the company operates	Number (N)	Average rank value	Kruskal-Wallis test	
F(P25) average values of the responses of company representatives on the use of indicators of the effectiveness of the health and safety management system at work	Bosnia and Herzegovina	42	40,44	Chi-square	4,386
	Serbia	30	51,48		
	North Macedonia	14	53,39	df	3
	Montenegro	6	47,92		
	Total	92		Sig.	0,223

Asymptotic significance is shown. The degree of significance is 0,050.

By applying the Kruskal-Wallis test, the null hypothesis H01, related to the variable F(P25), was tested. The test showed that this hypothesis should be retained (Sig.=0,223).

Figure 2 shows the responses of the representatives of the surveyed companies related to the application of environmental protection system efficiency indicators. Companies were offered to comment on the monitoring of three indicators: *Degree*

of increase in green areas (P26A), *Index of greenhouse gas emissions* (P26B) and *Degree of reduction in electricity consumption* (P26C). In their answers, the surveyed companies responded with YES or NO, depending on whether they use a certain indicator in practice. Of the several answers offered, companies operating in BIH confirmed that they most often apply: *Degree of reduction in electricity consumption* (86%), *Degree of increase in green areas* (29%) and *Greenhouse gas emission index* (29%). Companies operating in SRB confirmed that from this group of indicators they monitor more often than others: *Degree of reduction in electricity consumption* (87%), *Greenhouse gas emission index* (50%), *Degree of increase in green areas* (37%). Companies operating in the MKD confirmed that from this group of indicators they monitor: "*Degree of reduction in electricity consumption*" (93%), *Greenhouse gas emission index* (50%). Finally, companies operating in MNEs confirmed that from this group of indicators they monitor: *Degree of reduction in electricity consumption* (100%), *Greenhouse gas emission index* (17%). This review shows that companies in all countries pay attention to the reduction of electricity, either as an indicator of environmental protection or as an indicator of increasing financial efficiency (the average for all three countries is 88% of surveyed companies). The *Greenhouse Gas Emission Index* indicator showed that companies in all four countries must apply more measures that have a positive effect in the direction of reducing the emission of harmful gases. When analyzing the answers of all the companies included in this survey, it can be seen that as an indicator companies most often follow the *degree of reduction in electricity consumption* (88%) and the *index of greenhouse gas emissions* (37%), and rarely follow the *degree of increase in green areas* (26%).
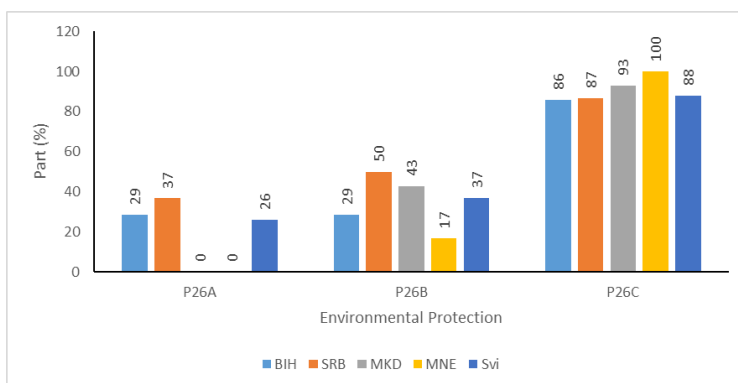

Figure 2. Overview of the identified indicators of the effectiveness of the environmental protection management system (N=92), The results show the share of companies in relation to the number of surveyed companies from each country (%). P26A - Degree of increase in green areas, P26B - Greenhouse gas emission index, P26C - Degree of reduction in electricity consumption

The average values of the company's responses regarding the application of indicators for the evaluation of the efficiency of the environmental protection management system are represented by the function

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$$F(P26) = Mean\ (P26A, P26B, P26C).$$

The descriptive values of the function F(P26) are shown in the table 4.

Table 4. Descriptive values of the function F(P26) of the average values of the answers about the presence of indicators of the efficiency of the environmental protection management system in relation to the country of origin

The country in which the undertaking operates	Number (N)	Average value	SD	GOPV	95% Confidence interval		Min.	Max.
					Lower limit	Lower limit		
Bosnia and Herzegovina	42	1,48	0,32	0,0497	1,37	1,58	1,00	2,00
Serbia	30	1,58	0,34	0,0617	1,45	1,70	1,00	2,00
North Macedonia	14	1,48	0,25	0,0673	1,33	1,62	1,00	2,00
Montenegro	6	1,39	0,14	0,0555	1,25	1,53	1,33	1,67
Total	92	1,50	0,31	0,0323	1,44	1,57	1,00	2,00

SD - Standard deviation; GOPV - Error of estimation of average value

Applying the Kruskal Walliss test, it was examined whether the average values of the response functions of company managers regarding the presence of indicators of the efficiency of the environmental management system are statistically significantly different in relation to the country in which the company operates. The results of applying the Kruskal Wollis test are given in table 5.

Table 5. Results of applying the Kruskal-Wallis test

	The country where the company operates	Number (N)	Average rank value	Kruskal-Wallis test	
F(P26) average values of company managers' answers about the presence of environmental management system efficiency assessment indicators	Bosna and Herzegovina	42	43,69	Chi-square	3,317
	Serbia	30	52,87		
	North Macedonia	14	45,21	df	3
	Montenegro	6	37,33		
	Total	92		Sig.	0,345

Asymptotic significance is shown. The degree of significance is 0,050.

By applying the Kruskal-Wallis test, the null hypothesis H02, related to the variable F(P26), was tested. The test showed that this hypothesis should be retained (Sig.=0,345).

Le et al. [19] investigated the importance of indicators and labels, which consumers take into account when buying safe vegetables. As sources of indicators, the authors used: the existence of a product label, information on the label about the place of production, trade reputation, possession of a certificate from a state institution, information from friends, price and appearance of the product. Liu et al. [20]

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conducted an analysis showing that trust has a strong influence on the consumer's purchase decision. The transparency of indicators of the effectiveness of the management system contributes to gaining that trust.

Numerous indicators are used in the food supply chain, especially to ensure the information necessary in the traceability system. Gallo et al.[21] developed a tool, which enables the management of heterogeneous traceability documents (records) collected along the food supply chain, which made it possible to define a dashboard of multidisciplinary indicators covering the three pillars of the food system: safety, costs and environmental sustainability.

Achieving the desired speed of collecting the necessary information and improving the efficiency of the FSMS can be significantly facilitated by the application of a specific information system. In this case, the application of the information system has its own contribution during the collection and processing of information, and the provision of proposals for measures to improve the existing management system/systems. [14-18].

Conclusion

Monitoring and analysis of the established indicators of environmental protection and occupational safety management systems contributes to the development and improvement of EMS and OHSAS. The advantages of applying the proposed model are reflected in improving efficiency, improving product quality and safety, increasing trust and better product sustainability, reducing work injuries and occupational diseases, and reducing the impact of the company's work on the environment.

During the conducted survey, companies stated that they monitor several indicators of the efficiency of the health and safety management system at work, indicators of the efficiency of the environmental protection management system. The adoption and monitoring of these indicators should be viewed from the point of view of confirming the hypotheses H_{01} i H_{02}.

Application of information and communication technologies to a significant extent can facilitate the system of monitoring the efficiency indicators of the system of management and processing of collected data.

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INDIKATORI EFIKASNOSTI SISTEMA UPRAVLJANJA U PREDUZEĆIMA PREHRAMBENE INDUSTRIJE

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Sažetak: Tokom implementacije standarda upravljanja neophodno je praćenje velikog broja parametara. Ukoliko bi se preduzeće odlučilo za praćenje svih parametara, primjena standarda bila bi veoma skupa, zbog čega je u ovom radu postavljen cilj da se predloži manji broj specifičnih parametara (indikatora efikasnosti), koji ukazuju na ključne promjene u sistemu upravljanja. U toku istraživanja provedena je anketa u preduzećima prehrambenog sektora u četiri države Balkana (Bosna i Hercegovina, Srbija, Sjeverna Makedonija i Crna Gora) u kojoj je od anketiranih preduzeća zatraženo da se izjasne da li primjenjuju (i u kojem obimu) indikatore efikasnosti sistema upravljanja zdravljem i bezbjednosti na radu i indikatore efikasnosti sistema upravljanja zaštitom životne sredine. Primjenom Kruskal Waliss-ovog testa ispitano je da li se prosječne vrijednosti funkcija odgovora predstavnika preduzeća o primjeni indikatora efikasnosti statistički značajno razlikuju u odnosu na državu u kojoj preduzeće posluje. Kada se analiziraju odgovori preduzeća iz svih država uključenih u ovu anketu, može se zapaziti da preduzeća kao indikatore efikasnosti sistema upravljanja zdravljem i bezbjednosti na radu najčešće prate Broj incidenata na radu (86%), Izgubljeno vrijeme zbog povreda (76%) i Broj radnika sa profesionalnim oboljenjima (71%), a veoma rijetko prate Broj smrtnih slučajeva (12%) i Broj gojaznih osoba među zaposlenim (22%). Kao indikatore sistema upravljanja zaštitom životne sredine anketirana preduzeća najčešće prate Stepen smanjenja potrošnje električne energije (88%) i Indeks emisije gasova staklene bašte (37%), a rijetko prate Stepen povećanja zelenih površina (26%). Na osnovu Kruskal Waliss-ovog testa može se zaključiti da država u kojoj posluje preduzeće nije imala statistički značajan uticaj na distribuciju odgovora o primjeni analiziranih grupa indikatora efikasnosti.

Ključne riječi: Indikatori efikasnosti, sistem upravljanja zaštitom životne sredine, sistem upravljanja zdravljem i zaštitom na radu, prehrambeni sektor, države Balkana