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Quality assessment of occupational health and safety management at the level of business units making up the organizational structure of a coal mine: a case study

Zygmunt Korban*

Silesian University of Technology, Poland

The audit of the health and safety management system is understood as a form and tool of controlling. The objective of the audit is to define whether the undertaken measures and the obtained results are in conformity with the predicted assumptions or plans, whether the agreed decisions have been implemented and whether they are suitable in view of the accepted health and safety policy. This paper presents the results of an audit examination carried out on the system of health and safety management between 2002 and 2012 on a group of respondents, the employees of two mining departments (G-1 and G-2) of Jan, a coal mine. The audit was carried out using the questionnaire developed by the author based on the MERIT-APBK survey.

Keywords: health and safety management; audit; questionnaire surveys

1. Introduction

The level of work safety stems from the impact of the energetic hazard factor and the attitudes and behaviour of employees. The quality of the applied technical solutions is being constantly improved, reaching a satisfactory level, and therefore the reasons explaining why accidents (dangerous incidents) happen are frequently attributed to the way work tasks are carried out. Inattention and failure to follow the required applicable regulations are habitually the main cause of accidents and material loss. A thesis can be put forward propounding that there are reasons why people behave in a way that leads to an accident. These reasons may take the form of barriers, and their identification and elimination can ensure safer workplaces. Human error (human factor error) is the resultant of technical, organizational and psychological factors affecting an individual. Human error is defined as an action which deviates from the required standards and requirements of a situation. [1–5] We can distinguish omission (negligence) errors and execution errors (giving wrong instruction or providing wrong information, wrong sequence of task realization, run-time errors) which appear when the required procedures or standards of conduct are breached. As the surveys demonstrate, not only the improvement of working conditions, but also the elimination of dangerous behaviours and dangerous activities results in the rise of workplace safety levels. [6–10] Therefore, the behaviour-based safety (BBS) methodology is becoming increasingly popular. The methodology is based on the assumption that the level of occupational health and safety (OHS) depends on the

combination of three measurable factors: an employee, their behaviour and the environment. BBS encourages the employees to get involved in the issues of work safety improvement (joint responsibility for the OHS level). [11]

In Poland, the term OHS management became popular in the mid-1990s and involved principally matters connected with the organization and decision-making processes in a company. The need to implement the health and safety management rules was enforced not only by low efficiency of the analysis methods of safety condition used at that time, but also by legal aspects (the need to adjust the legal solutions in Poland to the requirements applicable in the member states of the European Union), economical aspects (different insurance premiums) and social reasons (no consent to work in high hazard and accident conditions).

The management process of the OHS must provide means and tools ensuring proper monitoring of the undertaken actions and their supervision along all management levels. These objectives are realized, among other things, by the use of audit examinations of the health and safety management system. In accordance with the Polish Standard, audit is a systematic and independent examination with the aim to determine whether proper actions are undertaken, whether the obtained results correspond to the expected arrangements and whether these arrangements have been implemented. [12]

With respect to the audit of the health and safety management system, it is also worthwhile emphasizing that every single employee can take part in it. Every employee

*Corresponding author. Email: zygmunt.korban@polsl.pl

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can participate in the assessment process of the health and safety management system.

In the audit examinations of the health and safety management system we can single out a strategic audit (company level), tactical audit (level of company organizational units) and operational audit (executive level). In each of these cases, both the internal and external audits can be performed. The examinations can include the entire community (surveys of the entire population, called exhaustive surveys) or the selected units only (called non-exhaustive surveys).¹ This article discusses the results of an external audit performed on a group of employees from two mining departments, i.e., departments G-1 (129 people) and G-2 (143 people) at Jan, a coal mine. The author's questionnaire based on the method management evaluation regarding itemised tendencies (MERIT) method [13] was used in the surveys. The number of people in the two groups taking part in the audit ranged from 80 to 123, which accounted for 62–86% of the total number of employees working in the departments. The audit examinations were carried out every quarter between 2002 and 2012, and they were developing the research problem investigated by the author in his doctoral dissertation.[14]

2. Questionnaire surveys as a research tool for quality assessment of health and safety management

Questionnaire surveys were used for the quality assessment of health and safety management at the organizational level (departments) selected for the audit from the organizational structure of Jan. In such surveys, three basic phases can be identified: survey design phase, data collection phase and result analysis phase.

In the first phase the problem is formulated, the situation is analysed and the research task is defined. The second phase includes the analysis of secondary data,² the determination of the primary data collection method,³ the testing of research tools and the execution of surveys, while the third phase consists of the analysis and interpretation of data and the assessment of results.

In the questionnaire surveys, the respondents replied in writing to 26 questions divided into 12 problem areas (A–L):

- Area A. Assessment of task setting at the department, taking into consideration the OHS issues.
- Area B. Assessment of work adjustment to psychophysical abilities of the employees.
- Area C. Assessment of the reliability of machines and work tools as well as their availability at workplaces.
- Area D. Assessment of the knowledge of OHS issues necessary for safe working.
- Area E. Assessment of the promotion quality of OHS principles at workplaces within the department.
- Area F. Assessment of the incentives motivating to safe work at the department.
- Area G. Assessment of the occupational risk related to the performed activities.
- Area H. Assessment of the knowledge of near-miss incident investigations conducted at the department.
- Area I. Assessment of the knowledge of the principles of modern health and safety management.
- Area J. Assessment of the quality of OHS training carried out at the department.
- Area K. Assessment of the organization of safe work at the department.
- Area L. Assessment of law and order at the department.

Each respondent was to choose only one answer to each of the questions, scored from 0 to 5 (0 = *fail*, 5 = *ideal*), i.e., the answer which, in their opinion, provides the best description of the realization status of the activities undertaken in a specific health and safety management area at their department. Based on the obtained answers, rating indexes were determined for individual problem areas (WOP_i), and then the health and safety management quality rating index (W_{jo}) was determined for the entire department as the arithmetic mean of WOP_i values. The mathematical model used in the examinations was discussed in the doctoral dissertation of the author.[14]

3. Discussion of survey results

The values of partial (WOP_i) and final (W_{jo}) ratings are shown in Figures 1–4.

The summary of evaluation measures of goodness of fit between the trend function and the set of empirical data is presented in Table 1. The areas of variability and mean values of WOP_i ratings in individual problem areas are provided in Table 2. The values of variability index for each of the problem areas in the consecutive years are provided in Table 3, and the seasonal fluctuations are specified in Tables 4 and 5.

A linear trend function was used for the description of changes in the rating indexes. In the case of the values of the final rating index W_{jo} , the fitting of the trend function for the investigation results of both departments was similar: for department G-1 the coefficient of determination R^2 was 0.7147 (trend function $\hat{y}_t = 0.0043t + 3.148$) and for the department G-2 it was 0.7737 (trend function $\hat{y}_t = 0.0021t + 2.5549$).

With reference to the individual areas, the best fitting of the trend function (Table 1) was for areas:

- K 'Assessment of the organization of safe work at the department' (department G-2): 92.1% (standard error of parameter $a = 0.0004$, standard error of parameter $b = 0.0122$),

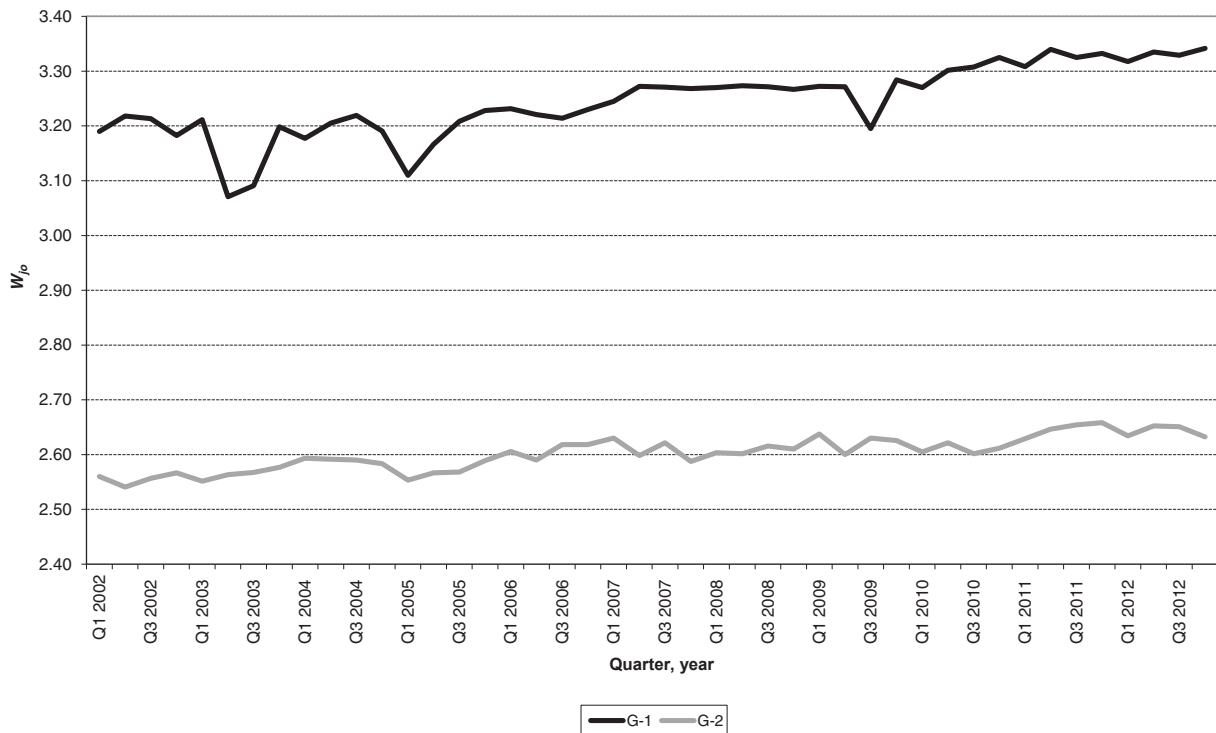


Figure 1. Department-wide operational audit of the health and safety management system: values of the final rating index j_o in successive editions for departments G-1 and G-2.

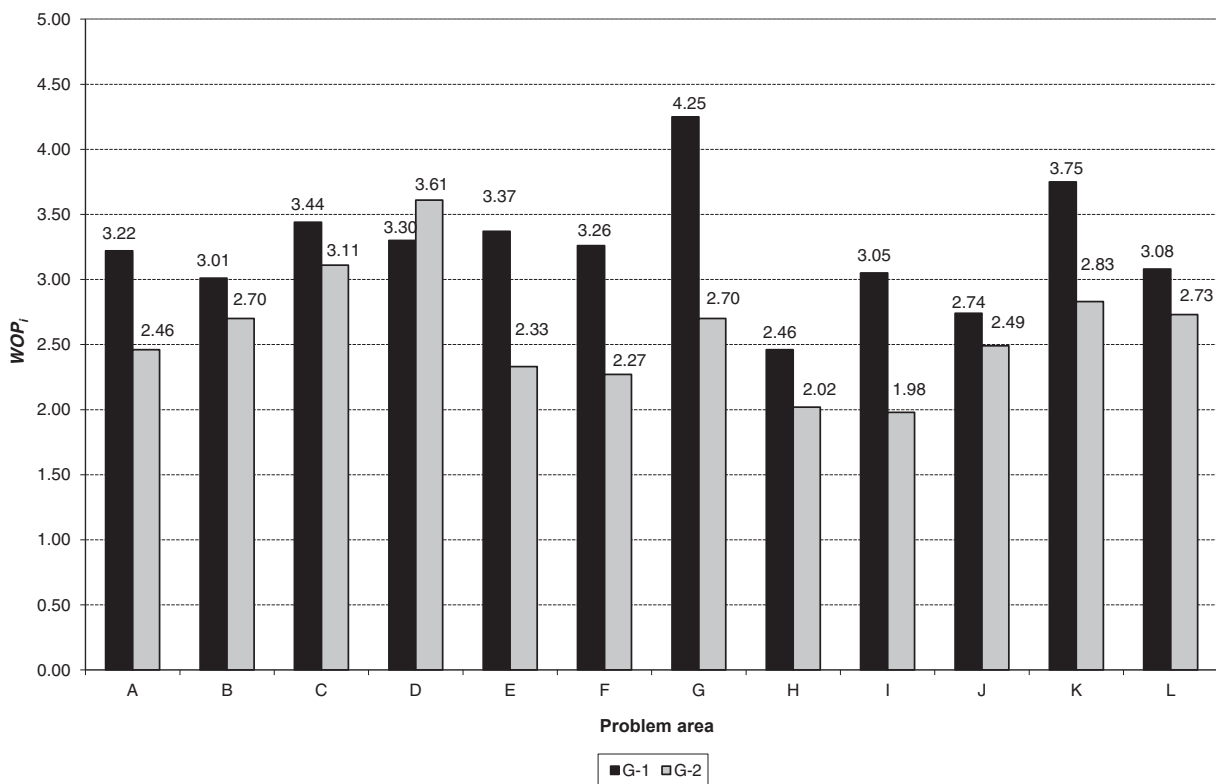


Figure 2. Department-wide operational audit of the health and safety management system: arithmetic means of WOP_i ratings for individual problem areas between 2002 and 2012.
 Note: WOP_i = partial rating.

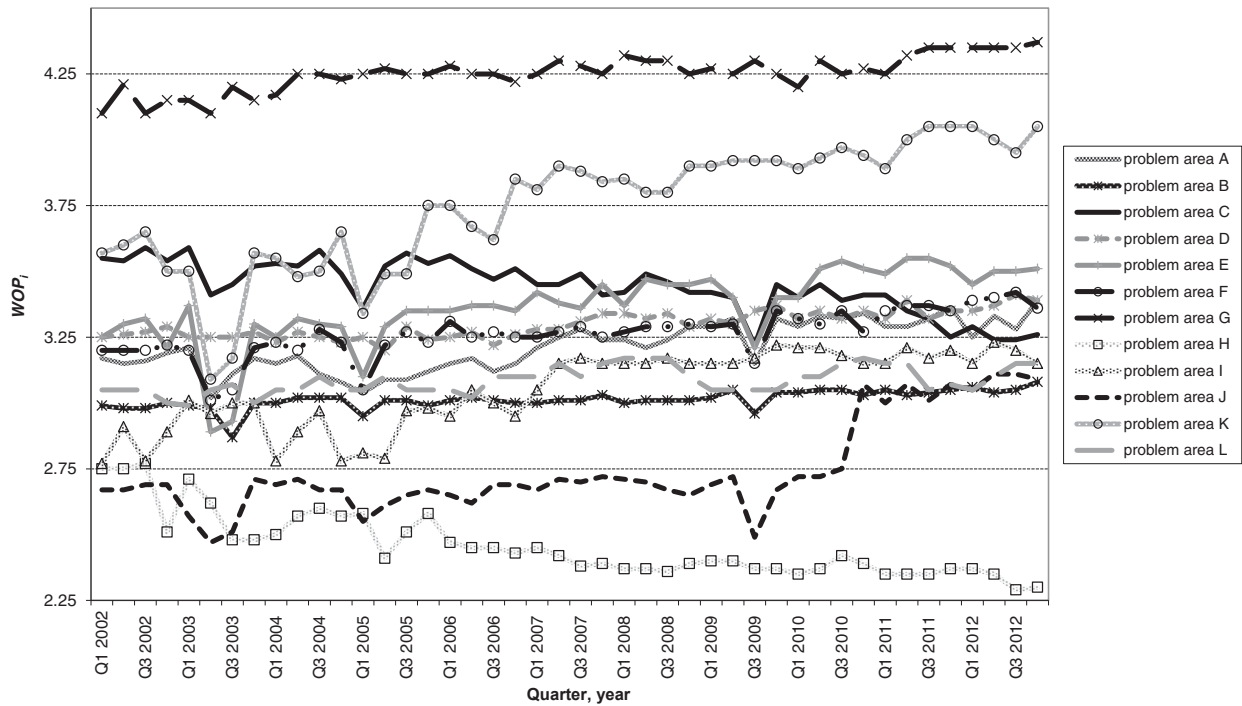


Figure 3. Department-wide operational audit of the health and safety management system (department G-1): summary of WOP_i rating indexes between 2002 and 2012.
 Note: WOP_i = partial rating.

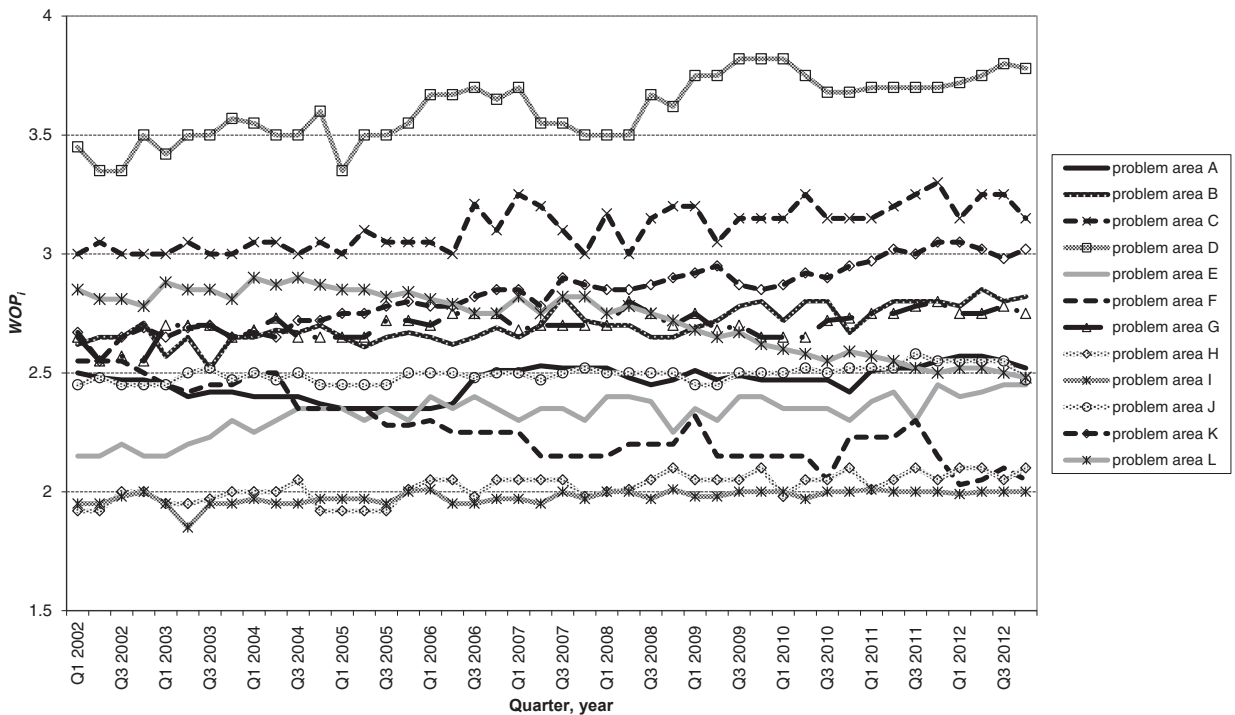


Figure 4. Department-wide operational audit of the health and safety management system (department G-2): summary of WOP_i rating indexes between 2002 and 2012.
 Note: WOP_i = partial rating.

- L ‘Assessment of law and order at the department’ (department G-2): 82.9% (standard error of parameter $a = 0.0007$, standard error of parameter $b = 0.0169$),
- F ‘Assessment of the incentives motivating to safe work at the department’(department G-2): 76.8% (standard error of parameter $a = 0.0009$, standard error of parameter $b = 0.0221$),

Table 1. Evaluation measures of goodness of fit between the theoretical data of the trend function and the set of empirical data.

Department	Problem area	\hat{y}_t	$S(e_t)$	R^2	$S(a)$	$S(b)$
G-1	A	$\hat{y}_t = 0.0057t + 3.0861$	0.0569	0.6313	0.0006	0.0162
	B	$\hat{y}_t = 0.0019t + 2.9712$	0.0257	0.4680	0.0006	0.0145
	C	$\hat{y}_t = -0.0063t + 3.5842$	0.0609	0.6462	0.0007	0.0183
	D	$\hat{y}_t = 0.0033t + 3.2239$	0.0289	0.6880	0.0009	0.0244
	E	$\hat{y}_t = 0.0082t + 3.1824$	0.0988	0.5363	0.0007	0.0170
	F	$\hat{y}_t = 0.0053t + 3.1461$	0.0572	0.5880	0.0009	0.0221
	G	$\hat{y}_t = 0.0043t + 4.1553$	0.0405	0.6582	0.0005	0.0141
	H	$\hat{y}_t = -0.0082t + 2.6419$	0.0639	0.7360	0.0005	0.0122
	I	$\hat{y}_t = 0.0096t + 2.8355$	0.0786	0.7165	0.0003	0.0071
	J	$\hat{y}_t = 0.0101t + 2.5174$	0.1209	0.5389	0.0003	0.0079
	K	$\hat{y}_t = 0.0158t + 3.3956$	0.1229	0.7350	0.0004	0.0112
	L	$\hat{y}_t = 0.0022t + 3.0362$	0.0427	0.3010	0.0007	0.0169
G-2	A	$\hat{y}_t = 0.0029t + 2.3977$	0.0529	0.3369	0.0006	0.0162
	B	$\hat{y}_t = 0.0046t + 2.5992$	0.0472	0.6118	0.0006	0.0145
	C	$\hat{y}_t = 0.0054t + 2.9872$	0.2930	0.5848	0.0008	0.0183
	D	$\hat{y}_t = 0.0084t + 3.4232$	0.0794	0.6514	0.0009	0.0244
	E	$\hat{y}_t = 0.0049t + 2.2173$	0.0555	0.5652	0.0007	0.0172
	F	$\hat{y}_t = -0.0101t + 2.4968$	0.0721	0.7680	0.0009	0.0221
	G	$\hat{y}_t = 0.0029t + 2.6365$	0.0458	0.3976	0.0005	0.0141
	H	$\hat{y}_t = 0.0032t + 1.9474$	0.0397	0.5248	0.0005	0.0122
	I	$\hat{y}_t = 0.0014t + 1.9457$	0.0233	0.3764	0.0003	0.0071
	J	$\hat{y}_t = 0.0016t + 2.4575$	0.0258	0.4029	0.0003	0.0079
	K	$\hat{y}_t = 0.0096t + 2.6146$	0.0365	0.9210	0.0004	0.0112
	L	$\hat{y}_t = -0.0093t + 2.9363$	0.0551	0.8293	0.0007	0.0169

Note: \hat{y}_t = linear trend function ($\hat{y}_t = at + b$, where a, b = estimated structural parameters of the linear trend function, t = time); $S(e_t)$ = standard deviation of residual component (mean error of estimate); R^2 = coefficient of determination; $S(a)$ = standard error of structural parameter a of linear trend function; $S(b)$ = standard error of structural parameter b of linear trend function.

Table 2. Areas of variability and mean values of partial ratings for departments G-1 and G-2.

Problem area	WOP _{imin}		WOP _{imax}		O (WOP _i)	
	G-1	G-2	G-1	G-2	G-1	G-2
A	3.02	2.35	3.39	2.57	3.22	2.46
B	2.87	2.52	3.08	2.85	3.01	2.70
C	3.22	3.00	3.59	3.30	3.44	3.11
D	3.20	3.35	3.41	3.82	3.30	3.61
E	2.89	2.15	3.55	2.45	3.37	2.33
F	3.01	2.03	3.42	2.55	3.26	2.27
G	4.10	2.55	4.37	2.80	4.25	2.70
H	2.29	1.92	2.77	2.10	2.46	2.02
I	2.77	1.85	3.23	2.01	3.05	1.98
J	2.47	2.45	3.11	2.58	2.74	2.49
K	3.09	2.55	4.05	3.05	3.75	2.83
L	2.99	2.48	3.17	2.90	3.08	2.73

Note: WOP_{imin} = minimum value of partial assessments WOP_i; WOP_{imax} = maximum value of partial assessments WOP_i; O (WOP_i) = mean value of partial assessments WOP_i; G-1, G-2 = departments.

assessed within the scope of the department wide operational audit carried out in department G-2.

With respect to the department-wide operational audit carried out in department G-1, the best fitting of the trend

function was observed for areas:

- H ‘Assessment of the knowledge of near-miss incident investigations conducted at the department’: 73.6% (standard error of parameter $a = 0.0005$, standard error of parameter $b = 0.0122$),
- K ‘Assessment of the organization of safe work at the department’: 73.5% (standard error of parameter $a = 0.0004$, standard error of parameter $b = 0.0112$),
- I ‘Assessment of the knowledge of the principles of modern health and safety management’: 71.7% (standard error of parameter $a = 0.0003$, standard error of parameter $b = 0.0071$).

The worst fitting of the trend function was observed for areas:

- L ‘Assessment of law and order at the department’ (department G-1): 30.1% (standard error of parameter $a = 0.0007$, standard error of parameter $b = 0.0169$),
- A ‘Assessment of task setting at the department, taking into consideration the OHS issues’

Table 3. Variability index of partial ratings for departments G-1 and G-2.

Department	Problem area	Year										
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
		$V(WOP_i)$										
G-1	A	0.539	2.642	1.405	1.075	0.655	0.890	1.022	2.484	0.651	1.000	1.851
	B	0.320	2.046	0.332	0.946	0.271	0.418	0.166	1.336	0.315	0.315	0.559
	C	0.670	2.271	1.060	2.648	1.049	0.947	0.987	3.076	0.771	1.996	0.725
	D	0.523	0.307	0.590	1.139	0.665	0.870	0.711	0.932	0.519	0.992	0.764
	E	1.519	7.929	0.895	3.619	0.344	1.185	1.291	3.313	1.766	0.814	0.776
	F	0.312	3.286	1.025	3.052	0.865	0.586	0.383	2.621	1.017	0.344	0.737
	G	1.263	0.984	0.896	0.235	0.576	0.574	0.696	0.554	0.988	1.093	0.230
	H	4.590	4.391	1.657	3.191	0.667	1.312	0.530	0.726	1.253	0.425	1.659
	I	2.564	0.741	3.242	3.513	1.602	1.730	0.317	1.041	0.901	0.865	1.240
	J	0.431	4.095	0.713	2.020	1.278	0.800	1.027	3.925	6.060	1.243	0.915
	K	1.752	7.136	2.142	4.843	2.699	1.045	1.247	0.255	0.840	1.887	1.193
	L	0.823	1.276	0.816	0.816	1.287	0.924	1.110	0.000	1.137	1.694	1.538
G-2	A	0.570	0.851	0.627	0.000	3.268	0.324	1.187	0.771	1.017	0.686	0.926
	B	1.420	2.463	0.778	0.951	1.083	2.621	1.079	1.865	2.328	0.897	1.062
	C	0.830	0.830	0.823	1.339	2.907	3.534	2.846	2.005	1.575	2.002	1.804
	D	2.198	1.753	1.353	2.492	0.561	2.422	2.412	1.068	1.796	0.000	0.930
	E	1.156	2.825	2.070	1.242	1.215	1.242	3.066	2.026	1.070	2.723	1.008
	F	0.985	0.614	3.571	1.746	1.105	2.299	1.143	3.877	3.436	2.752	1.451
	G	1.845	0.930	1.410	1.505	0.913	0.371	1.749	1.560	1.618	0.884	0.544
	H	2.357	1.201	2.699	2.317	1.722	1.722	2.228	1.212	2.412	1.796	1.198
	I	1.243	2.597	0.589	1.045	1.436	1.045	0.868	0.580	0.753	0.250	0.250
	J	0.610	1.251	0.988	1.015	0.401	0.825	0.000	1.166	0.460	1.130	1.581
	K	2.355	0.984	1.323	0.884	1.212	1.789	0.824	1.578	1.157	1.118	0.952
	L	1.021	1.009	0.600	0.498	1.081	1.249	0.891	0.997	0.837	1.226	0.764

Note: $V(WOP_i)$ = variability index of partial assessments WOP_i .

Table 4. Department G-1: raw and adjusted frequency indexes for individual quarters by problem area.

Problem area	Raw seasonal indexes					Adjustment factor	Adjusted seasonal indexes			
	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter		2nd quarter	3rd quarter	4th quarter	
A	0.0024	0.0012	-0.0190	0.0180	0.0006	0.0017	0.0006	-0.0197	0.0174	
B	-0.0011	0.0052	-0.0140	0.0059	-0.0010	-0.0001	0.0062	-0.0130	0.0069	
C	0.0008	-0.0020	-0.0048	0.0025	-0.0009	0.0017	-0.0011	-0.0039	0.0033	
D	-0.0059	-0.0001	0.0029	0.0042	0.0003	-0.0062	-0.0004	0.0027	0.0039	
E	0.0018	-0.0010	-0.0183	0.0153	-0.0005	0.0023	-0.0004	-0.0177	0.0159	
F	0.0026	-0.0072	-0.0007	0.0012	-0.0010	0.0036	-0.0062	0.0003	0.0023	
G	-0.0101	0.0137	0.0076	-0.0094	0.0004	-0.0106	0.0133	0.0072	-0.0099	
H	0.0121	-0.0015	-0.0006	-0.0106	-0.0001	0.0122	-0.0014	-0.0004	-0.0104	
I	-0.0207	0.0169	0.0146	-0.0095	0.0003	-0.0211	0.0166	0.0143	-0.0099	
J	-0.0050	-0.0023	-0.0279	0.0311	-0.0010	-0.0040	-0.0010	-0.0270	0.0320	
K	0.0090	-0.0268	-0.0317	0.0452	-0.0011	0.0100	-0.0260	-0.0310	0.0460	
L	-0.0088	0.0054	0.0077	-0.0081	-0.0009	-0.0080	0.0060	0.0090	-0.0070	

(department G-2): 33.7% (standard error of parameter $a = 0.0006$, standard error of parameter $b = 0.0162$),

- I ‘Assessment of the knowledge of the principles of modern health and safety management’ (department G-2): 37.6% (standard error of parameter $a = 0.0003$, standard error of parameter $b = 0.0071$),
- G ‘Assessment of occupational risk related to the performed activities’ (department G-2): 39.8%

(standard error of parameter $a = 0.0005$, standard error of parameter $b = 0.0141$).

The downward tendencies of the trend function were observed for four problem areas: C ‘Assessment of the reliability of machines and work tools as well as their availability at workplaces’ ($a = -0.0063$), F ‘Assessment of the incentives motivating to safe work at the department’ ($a = -0.0101$), H ‘Assessment of the knowledge of near-miss incident investigations conducted at the department’

Table 5. Department G-2: raw and adjusted frequency indexes for individual quarters by problem area.

Problem area	Raw seasonal index				Adjustment factor	Adjusted seasonal index			
	1st quarter	2nd quarter	3rd quarter	4th quarter		1st quarter	2nd quarter	3rd quarter	4th quarter
A	0.0087	-0.0033	0.0011	-0.0064	0.0000	0.0087	-0.0033	0.0011	-0.0064
B	-0.0203	0.0069	0.0032	0.0068	-0.0009	-0.0195	0.0078	0.0041	0.0076
C	0.2326	0.2407	0.2561	0.2469	0.2441	-0.0115	-0.0034	0.0120	0.0029
D	0.0031	-0.0153	-0.0009	0.0088	-0.0011	0.0042	-0.0142	0.0001	0.0099
E	-0.0038	-0.0033	0.0118	-0.0076	-0.0007	-0.0031	-0.0025	0.0126	-0.0069
F	0.0135	-0.0019	-0.0072	-0.0035	0.0002	0.0133	-0.0021	-0.0075	-0.0037
G	-0.0010	0.0006	0.0077	-0.0106	-0.0008	-0.0002	0.0015	0.0085	-0.0098
H	-0.0119	-0.0042	0.0035	0.0131	0.0001	-0.0120	-0.0043	0.0034	0.0129
I	0.0067	-0.0156	-0.0006	0.0089	-0.0002	0.0069	-0.0154	-0.0005	0.0090
J	-0.0029	-0.0009	0.0084	-0.0023	0.0006	-0.0040	-0.0010	0.0080	-0.0030
K	0.0047	-0.0113	0.0001	0.0050	-0.0004	0.0050	-0.0110	0.0000	0.0050
L	0.0072	-0.0044	-0.0006	-0.0058	-0.0009	0.0080	-0.0040	0.0000	-0.0050

($a = -0.0082$) and L 'Assessment of law and order at the department' ($a = -0.0093$). For areas C and H the downward tendencies involve department G-1, and for areas F and L the downward tendencies involve department G-2.

The highest growth dynamics was observed for areas K ($a = 0.0158$) and J ($a = 0.0101$), assessed in the audit by the staff of department G-1.

Due to the impact of seasonal fluctuations, the differences between the determined rating index and the trend were the highest for area K 'Assessment of the organization of safe work at the department' (in the 4th quarters the value WOP_K was higher as compared to the trend by 0.046) and for area J 'Assessment of the quality of OHS training at the department' (in the 4th quarters the value WOP_J was higher as compared to the trend by 0.032). In both cases, the obtained results involve the results of audit examinations carried out in department G-1 (Tables 4 and 5).

The mean value of the final rating index W_{jo} was 3/24 for department G-1 between 2002 and 2012 and 2.60 for department G-2. In neither quarter was the final rating index of the department-wide operational audit W_{jo} for department G-2 higher than that obtained for department G-1 (Table 1). The differences between the final rating indexes in individual quarters ranged between 0.51 and 0.71.

The determined values of variability indexes (Table 3) show explicitly that there is a slight diversity of WOP_i ratings within each of the problem areas: standard deviation here is approximately 6.1% of the mean value at the most (department G-1, area J in 2010).

In the opinion of the respondents from department G-1, the instructions they are given are clear and comprehensible ($WOP_A = 3.22$). However, the employees are not informed how to safely execute the assigned tasks in spite of the fact that workplaces are supervised on a regular basis. The employees know how to fulfil their obligations safely ($WOP_D = 3.3$) and they can use the possessed knowledge practically ($WOP_K = 3.75$).

As to the supervising staff in department G-2, the tasks are formulated in an unclear manner, while the control over the performed works is occasional (WOP_A is only 2.46). Most employees declare that they have sufficient knowledge and skills to fulfil their obligations safely ($WOP_D = 3.611$ and $WOP_K = 2.83$).

The assigned tasks often exceed the psychophysical abilities and capabilities of the staff, and the measures aiming to reduce the workload the employees are burdened with are undertaken occasionally (department G-1) or seldom (department G-2). For department G-1 the WOP_B index is 3.01 (10th place in the problem area ranking) and for department G-2 the WOP_B index is 2.702 (5th place in the problem area ranking).

In the opinion of the respondents, only a small part of machines and equipment does not meet safety requirements (e.g., damaged rope windlass shields or malfunctioning loudspeakers on walls). In most cases the employees have access to operational tools in good condition and to proper protective equipment which they use as instructed. In the ranking of problem areas, area C was placed third ($WOP_C = 3.44$ in the audit in department G-1) and second ($WOP_C = 3.11$ in the audit in department G-2).

In the case of department G-1, modern and comprehensible means promoting work safety rules are used (e.g., large outdoor screens), and the information provided to the staff is updated on a regular basis ($WOP_E = 3.37$). In department G-2, the promotion of OHS rules is rather occasional ($WOP_E = 2.33$). In the department's system of rewards and punishments (department G-1), the positive motivation system promoting proper behaviour and attitudes of employees is predominating ($WOP_F = 3.26$). In the case of department G-2, this system is unclear and used selectively ($WOP_F = 2.27$).

In the opinion of the employees of department G-1, the assessment of occupational risk is carried out for each workplace and all employees are informed about the level of such risk. Area G got the mark 4.25 and took the first

place in the ranking. For department G-2 this area was placed 6th ($WOP_G = 2.701$). In this case the employees claim that they are informed about the level of risk, but the rating itself is updated occasionally.

In the opinion of the respondents, near-miss incidents are hardly ever analysed. It is possible to report such situations, but they are not reviewed. In the audit examinations carried out in department G-1, this area was placed last in the problem areas ranking ($WOP_H = 2.46$), while in the case of the audit carried out in department G-2, it finished last but one ($WOP_H = 2.02$).

With respect to the staff of department G-1 we can say that they know basic principles and procedures of the health and safety management programme used at the coal mine ($WOP_I = 3.05$). In the case of department G-2, the employees have no knowledge about the basic principles and procedures of the health and safety management programme. This is the only area with the rating index below 2 ($WOP_I = 1.98$). The employees from this department had no knowledge of the objectives of this programme and did not know that they could participate in the programme, evaluating the decisions made with regard to work safety management.

The quality of OHS training was assessed as poor ($WOP_J = 2.74$ for department G-1 and $WOP_J = 2.49$ for department G-2). The reasons for this situation can be attributed to the limited time dedicated to weekly OHS training. In the opinion of the respondents, the information from post-accident statements is not discussed and the content of periodic OHS briefings for the supervision personnel is passed out to the staff occasionally.

The order at workplaces at the department is reposted mainly by the staff of department G-1 ($WOP_L = 3.08$). The situation in this respect is definitely worse in department G-2 ($WOP_L = 2.73$). In the opinion of the respondents, there are frequent conflicts between employees.

4. Conclusion

The management of health and safety is frequently considered to be as important as production. Such an attitude has been enforced by economic calculation, legal regulations as well as the lack of social consent to work in conditions that pose hazards to human life or health. Therefore the application of OHS controlling is becoming more common. The audit of the health and safety management system, viewed as a form and tool of controlling, is an example of a modern research instrument. It allows us to analyse the potential hazard and then to identify and implement necessary preventive measures. The safety management is based on the assumption that dangerous activities, work conditions and accidents should be treated as phenomena (incidents) which reflect malfunctions of the management system. The audit of the health and safety management system allowed us to propagate the idea of participation among the staff (the awareness of co-responsibility for the

matters involving OHS), which is also in compliance with the methodology of BBS.

In the author's opinion, the surveys presented in this article may supplement the MERIT method used in coal mines for the assessment of the health and safety management quality at the strategic level. The discussed research studies not only allow us to keep track of the changes in the values of rating indices in time, but they will also be helpful to identify 'strong' and 'weak' aspects of OHS management at particular departments of a company.

In the case of both audited departments, the assessment of conditions under which the work tasks are performed has been confirmed by accident statistics. Between 2002 and 2012, no fatal accidents were reported in department G-1 ($W_{jo} = 3.24$), whereas in department G-2 ($W_{jo} = 2.60$) there was one fatal accident. Within the referred period, in department G-1, 78 accidents were reported altogether, including one serious one, while in department G-2 there were 125 accidents, including six serious ones. No fatal or mass accidents were reported in either department.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. Steczkowski [15] discusses the essence of the representative sampling methods.
2. Data collected for other purposes.
3. Information collected for specific research purposes (field research).

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