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The Algorithm for Improving the Integrated Management System in a Mining Company in Poland

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Abstract: *Improving the efficiency of the mining company and mines falling within its composition, while maintaining the requirements of work safety and environmental protection. In the conditions of a market economy, improving the efficiency of functioning is a key necessity for mining enterprises. Mines need to be properly managed to survive. The key problem is the design and implementation of an efficient management system and its continuous improvement based on the adequacy of system solutions. It is an answer to the question whether the management system of the mining enterprise (mine) corresponds to its actual needs in the process of achieving the objectives. Improvement of management systems must be based on an appropriate diagnosis. The aim of the article is to present the original solution, which is a tool for improving the integrated management system in Polish mining enterprises.*

Keywords: *mining company, integrated management system, mining enterprises*

1. INTRODUCTION

The 2015 amendment of Polish Standards concerning the implementation, use and auditing of management systems recommended in this respect a new, so-called "process approach" [1, 2, 3, 4, 5, 6]. Instead of the previously applied interpretation of the requirements of individual standards as independent measures referring to the individual procedures, the process approach identifies the individual processes (main, auxiliary and accompanying processes) implemented in an enterprise [9, 10]. The order of their execution, interdependencies and manner of process management are determined through the establishment of methods assuring their effectiveness, monitoring and improvement [7, 8].

The necessity to apply a process approach was the reason for amending the methodology applied in scoring the effectiveness of the functioning of the integrated management system (IMS) described in the first part of the article. An attempt was made to adjust the ANG-standard (*ANG-norma*) sheet to the requirements of the new standards, which resulted in the AGN-process (*ANG-proces*) procedures and the creation of a new scoring sheet model.

2. THE ANG ALGORITHM PRESENTING THE COURSE OF PROCEDURE IN THE PROCESS APPROACH

The development of the ANG algorithm aimed at presenting the course of procedure in the process approach to management systems existing within the IMS in a given enterprise. On this basis, the structure of the ANG-process sheet was then prepared as a tool supporting measures designed to assess the effectiveness of the functioning of the IMS.

Based on the standards in force, it was assumed in the ANG-process procedure that the set process and the associated procedures would constitute audit "inputs" (Figure 1).

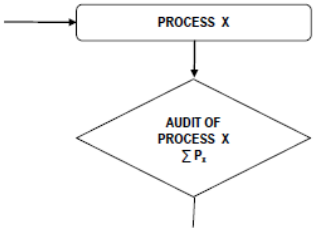

Figure1. *Audit inputs*

Source: *own elaboration*

If any non-conformances are revealed or observations are made, improvement measures should be implemented to remedy the shortcomings. These are:

- preventive measures – aimed at eliminating the causes of potential non-conformances or other undesired situations,
- corrective measures – aimed at eliminating the causes of non-conformances and preventing their recurrence,
- correction – aimed at correcting the identified non-conformances.

In order for the auditor to identify the areas for improvement, solutions may be suggested to improve activities within the process (Figure 2).

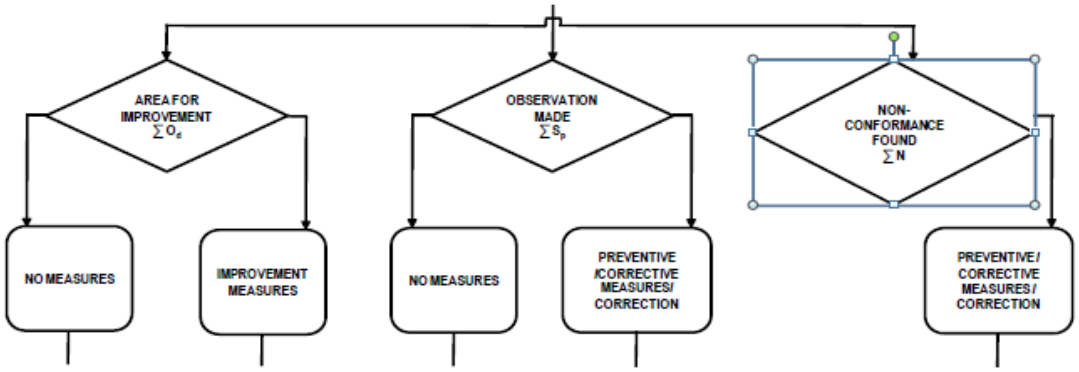

Figure2. *Finding non-conformances, making observations and identifying areas for improvement during an audit*

Source: *own elaboration*

Once the measures necessary for implementation to eliminate non-conformances or observations have been identified, the time for the implementation of corrective measures is clearly defined, and then the correctness of the implemented measures is verified.

The next stage involves the control of implementing the recommendations and corrective measures. It can be carried out, for example, by performing special-purpose audit. A positive assessment indicates well-proposed and correctly implemented corrective measures (Figure 3).

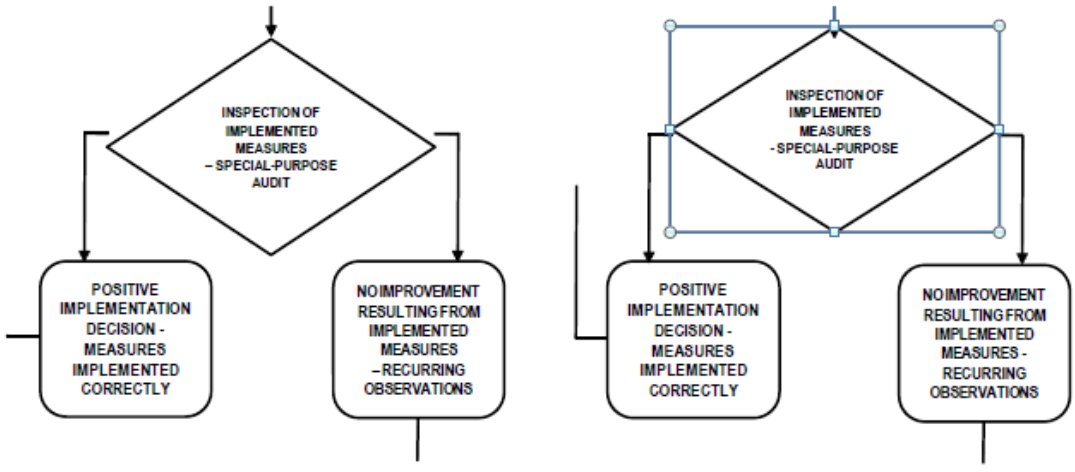

Figure3. *Scoring the implemented audit activities*

Source: *own elaboration*

In the case of a negative assessment – no improvement and repeated non-conformities / observation – the proposed measures are regarded as incorrect. In such a case, all the non-conformances and observations should be analysed and corrective measures should be re-implemented. In addition, one should consider whether the specific part of the procedure has not been defined wrongly, and what is the cause of the non-conformities and observations occurring despite the implemented improvement measures (Figure 4).

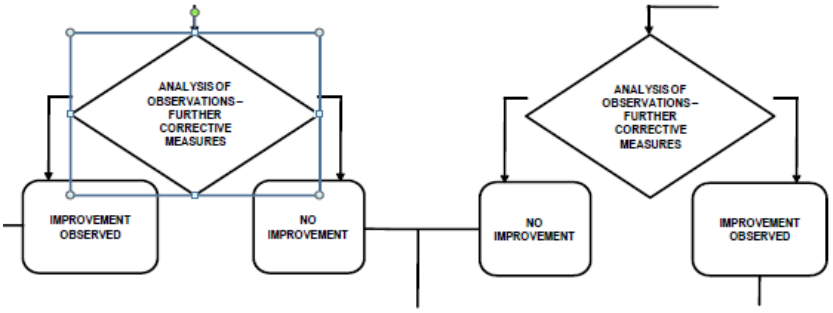

Figure4. *The analysis of observations and non-conformances after the implementation of corrective measures*
Source: own elaboration.

If, despite the implementation of subsequent measures, the situation recurs, this might mean that the procedure or its part has been erroneously defined or not adapted to the enterprise's reality. In such a case, it is necessary to conduct a substantive analysis involving representatives of departments to which the given procedure applies, the procedure owner, and the integrated management system specialist and his/her team. The entire process and individual procedures are analysed, with a special focus on the procedures in which non-conformances were found and observations were made. It is possible to employ discussion, surveys and consultation with other organisational units conducting the same or similar processes.

A report offering proposed changes to the procedure should be approved by the integrated management system specialist and submitted for approval by the management. Once approved, the proposed changes should be sent to the head office of the enterprise. At the head office, a team responsible for the integrated management system issues its opinion on the request. If the request is denied, and the proposed changes not approved by the integrated management system specialist, the meeting should be convened again and proposed changes analysed. If consent is given to the introduction of changes, it is the responsibility of the specialist in the branch to implement these into the procedure, present the amended procedure to the management and, following its approval, issue a publicly known order and supervising the process of introducing changes by the organisational units, to which the process applies, starting from changes to system documents and procedures, to evaluate the correctness of the changes made by the organisational units. To this end, a special-purpose audit is conducted or the effectiveness of the changes is verified during the next planned audit.

If an improved functioning of the process is recorded after the repeated recommendation to implement corrective or preventive measures or corrections, it may be regarded that the process or its part have been effectively improved (Figure 5).

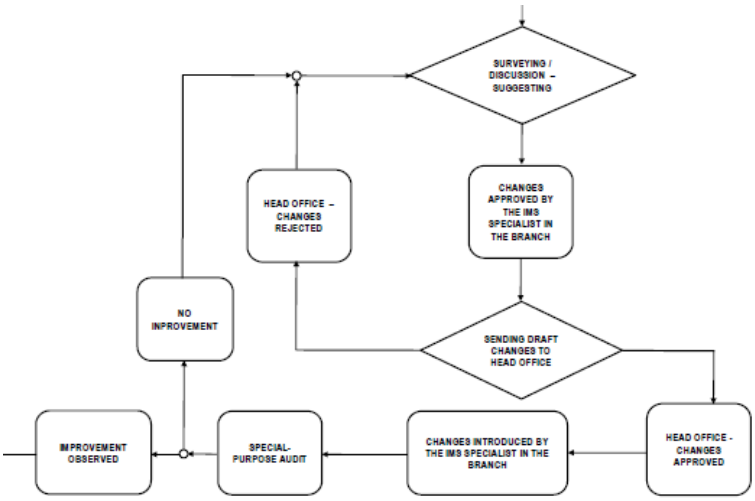

Figure5. *Analysing the process by means of proposed changes*

Source: *own elaboration.*

If an area for improvement is identified during the audit, either improvement measures may be implemented or the area may be left unaltered.

After taking into account all the recommendations associated with the introduction of changes to the process (through changes to the individual procedures), a follow-up audit (special-purpose audit)

should be conducted, aimed at evaluating the conformity and effectiveness of the introduced measures. Next, information from process audits preceding the introduction of changes and on the results of the special-purpose audit are analysed and included in the report on process audit activities. In order to include as much information as possible in the report, data from process monitoring and the ANG-process sheet (the tool supporting the scoring of the functioning of the integrated management system) should be used as inputs (Figure 6).

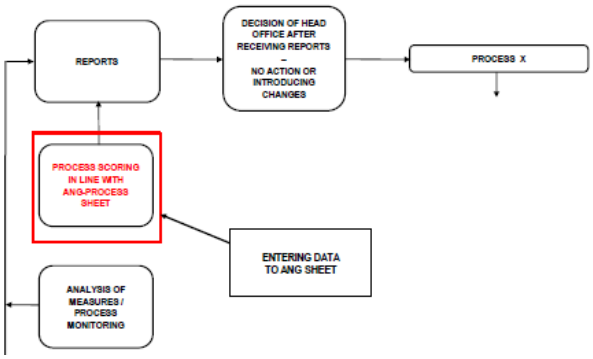

Figure6. *Reports – the analysis of the IMS effectiveness using the ANG-process sheet*

Source: *own elaboration.*

A comprehensive summary of all the described subsequent steps and procedural rules constitutes a methodology for evaluating and improving management systems (Figure 7).

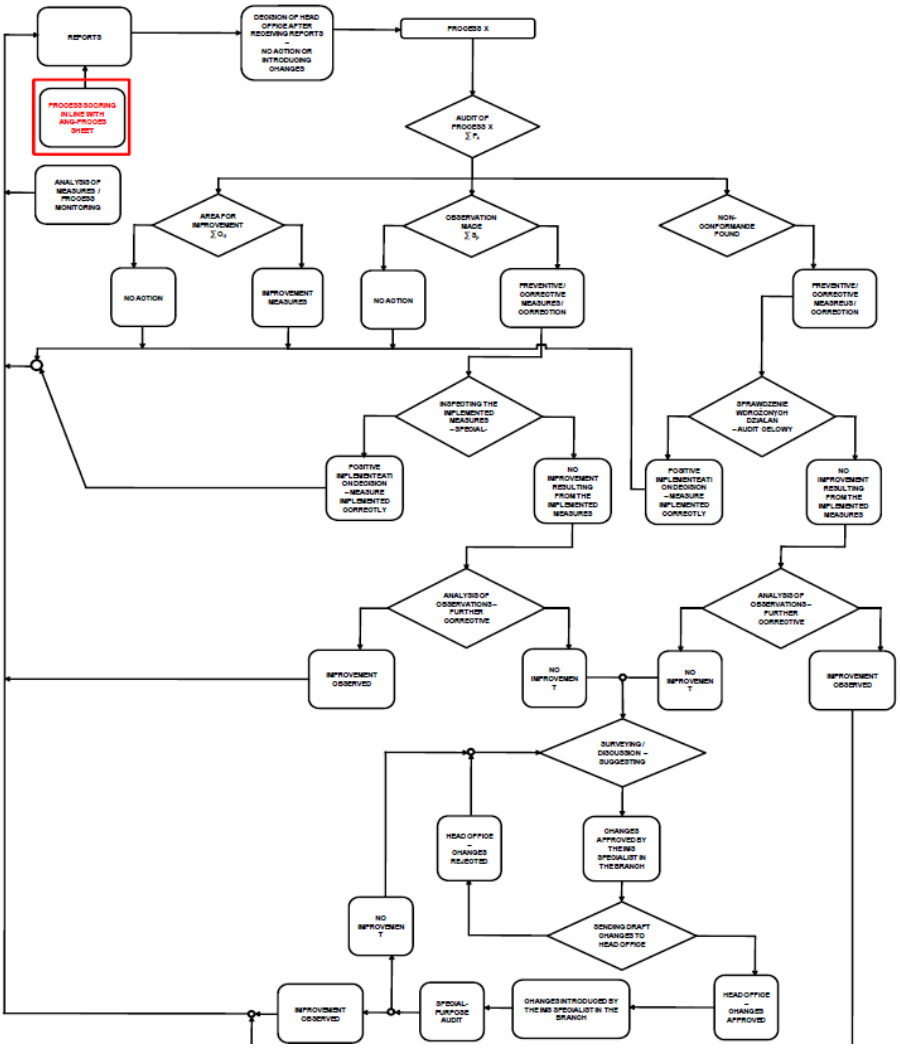

Figure7. *The ANG algorithm of scoring the effectiveness of the functioning of the integrated management system by evaluating the individual processes of the system*

Source: *own elaboration.*

3. CREATING THE ANG-PROCESS SHEET

The developed methodology, utilising the ANG-process sheet, is a proposal for scoring the system by evaluating its individual processes. This means that every process included in the audited process of a given system is analysed separately, while the results for the entire process are calculated and processed in the sheet. The task of the sheet is to automatically generate the score of a given process in relation to a single organisational unit (branch).

In order to score the effectiveness of the functioning of the integrated management system, one can apply the previously developed ANG-standard procedure, according to which the scoring is performed by:

- number of non-conformances K_N,
- number of observations K_{Sp},
- number of areas for improvement K_{Od}.

The following mathematical dependences are used in the developed formulas:

- process score by the number of non-conformances K_{Nr}:, observations K_{Spr} or areas for improvement K_{Od}:

$$K_N = N / P_x \times 10 \quad (1)$$

$$K_{Sp} = Sp / P_x \times 10 \quad (2)$$

$$K_{Od} = Od / P_x \times 10 \quad (3)$$

calculated as the quotient of the number non-conformances "N", observations "Sp" or areas for improvement "Od" and the number of processes in the analysed audit P_x;

(similarly as in the ANG-standard case, due to the low values of the aforementioned score, to facilitate their analysis, they are multiplied by 10);

In a newly developed ANG-process sheet, new formulas were introduced into the model, used to calculate:

- quarterly score by the number of non-conformances K_{Nkw}, observations K_{Spkw} or areas for improvement K_{Odkw}:

$$K_{Nkw} = \sum K_N / 3 \quad (4)$$

$$K_{Spkw} = \sum K_{Sp} / 3 \quad (5)$$

$$K_{Odkw} = \sum K_{Od} / 3 \quad (6)$$

calculated as the quotient of the sum of scores by the number of non-conformances, observations and areas for improvement in the analysed quarter and number of months in the quarter;

- half-year score by the number of non-conformances K_{Np}, observations K_{Spp} areas for improvement K_{Odp}:

$$K_{Np} = \sum K_N / 6 \quad (7)$$

$$K_{Spp} = \sum K_{Sp} / 6 \quad (8)$$

$$K_{Odp} = \sum K_{Od} / 6 \quad (9)$$

Calculated as the quotient of the sum of scores by the number of non-conformances, observations and areas for improvement in the analysed half-year and number of months in the half-year;

- annual score by the number of non-conformances K_{Nr}:, observations K_{Spr} or areas for improvement K_{Odr}:

$$K_{Nr} = \sum K_N / 12 \quad (10)$$

$$K_{Spr} = \sum K_{Sp} / 12 \quad (11)$$

$$K_{Odr} = \sum K_{Od} / 12 \quad (12)$$

Calculated as the quotient of the sum of scores by the number of non-conformances, observations and areas for improvement in the analysed year and number of months in the year;

The formulas of overall process score and overall branch score have been extended and adjusted to the reporting periods of the ANG-process sheet. This has yielded the formulas used to calculate:

- the overall quarterly score of the process:

$$K_{kw} = 3 \times K_{Nkw} + 2 \times K_{Spkw} + 0{,}1 \times K_{Odkw} \quad (13)$$

Calculated as the sum of the number of non-conformances, observations and areas for improvement in the analysed quarter, taking into account the relevant weights;

- the overall half-year score of the process:

$$K_p = 3 \times K_{Np} + 2 \times K_{Spp} + 0{,}1 \times K_{Odp} \quad (14)$$

Calculated as the sum of the number of non-conformances, observations and areas for improvement in the analysed half-year, taking into account the relevant weights;

- the overall annual score of the process:

$$K_r = 3 \times K_{Nr} + 2 \times K_{Spr} + 0{,}1 \times K_{Odr} \quad (15)$$

Calculated as the sum of the number of non-conformances, observations and areas for improvement in the analysed year, taking into account the relevant weights;

(the weights assigned to non-conformances, observations and areas for improvement in the overall score vary depending on their impact on the functioning of the integrated management system);

- the overall annual score of the branch (quarterly, half-year or annual):

$$K_{oox} = \sum K_x / P_x \quad (16)$$

calculated as the quotient of the sum of the quarterly, half-year or annual score and the number of audited processes in the given period.

The ANG-process takes into account the analysis of every process by individual procedures, utilising audit as a tool. After analysing the audit report, the results of the audits (including special-purpose audits) should be entered into the sheet, in the individual process tabs. The entered data are automatically transferred to "KWK __ – audit data" (*KWK __ – dane z auditów*) and "Data" (*Dane*) tabs, in which the mathematical formulas calculate the process score.

"Reports on the effectiveness of the functioning of the integrated management system", which include the number of non-conformances found, observations and areas for improvement as well as the scores of individual audited processes and the overall branch score, are generated in the sheet tabs for quarterly, half-year and annual reports.

The IMS specialist analyses the effectiveness of the processes implemented in individual organisational units. In the case of enterprises consisting of several branches, the sheet can be used to determine the effectiveness of the functioning of the system in individual branches and the effectiveness of the system in relation to the entire enterprise.

The procedure includes measures aimed at scoring individual processes and the entire system in a branch or the entire enterprise (it is also possible to score only one operation of a multi-operation branch). It is possible to quickly and easily obtain measurable data on the effectiveness of the processes and the functioning of the system in each of operations, branches and the entire enterprise.

One should remember that in the case of changes being introduced to the procedures, the process also changes. In enterprises, whose branches use the same procedures and their activities are based on the same processes, changes should be introduced in all branches, starting from the central unit. Such a necessity is observed frequently in the case of mining enterprises, which derive their procedures directly from the head office or imitate it.

One should bear in mind that every branch can function slightly differently. It might be the case that in some branches, following the changes, the system functions correctly, while in others its structure gets distorted. This means that the system in individual branches was developed based on their

specific conditions and that the introduced changes will not be adjusted to the reality of individual branches. In such a case, the IMS specialist should consult the measures introduced with the specialists in individual branches, who, in turn, should discuss this with the branches participating in the process affected by the changes. In justified cases it may turn out that the changes developed as a model central system should be considered only as a variant of process functioning.

The ANG-process sheet consists of five parts:

- tabs concerning the individual processes and the procedures within them,
- one "KWK __ – audit data" tab,
- three tabs – "Process score – by observations", "Process score by non-conformances", "Process score by areas for improvement",
- one "Data" tab,
- seven tabs for quarterly, half-year or annual reports.

Thanks to using the various functions of Excel, it is possible to easily move from one tab to another and collect data from various tabs.

Figure 8 illustrates a model tab concerning the process marked with the NDO symbol and the procedures encompass by it. The tabs concerning other processes are structured in a similar fashion.

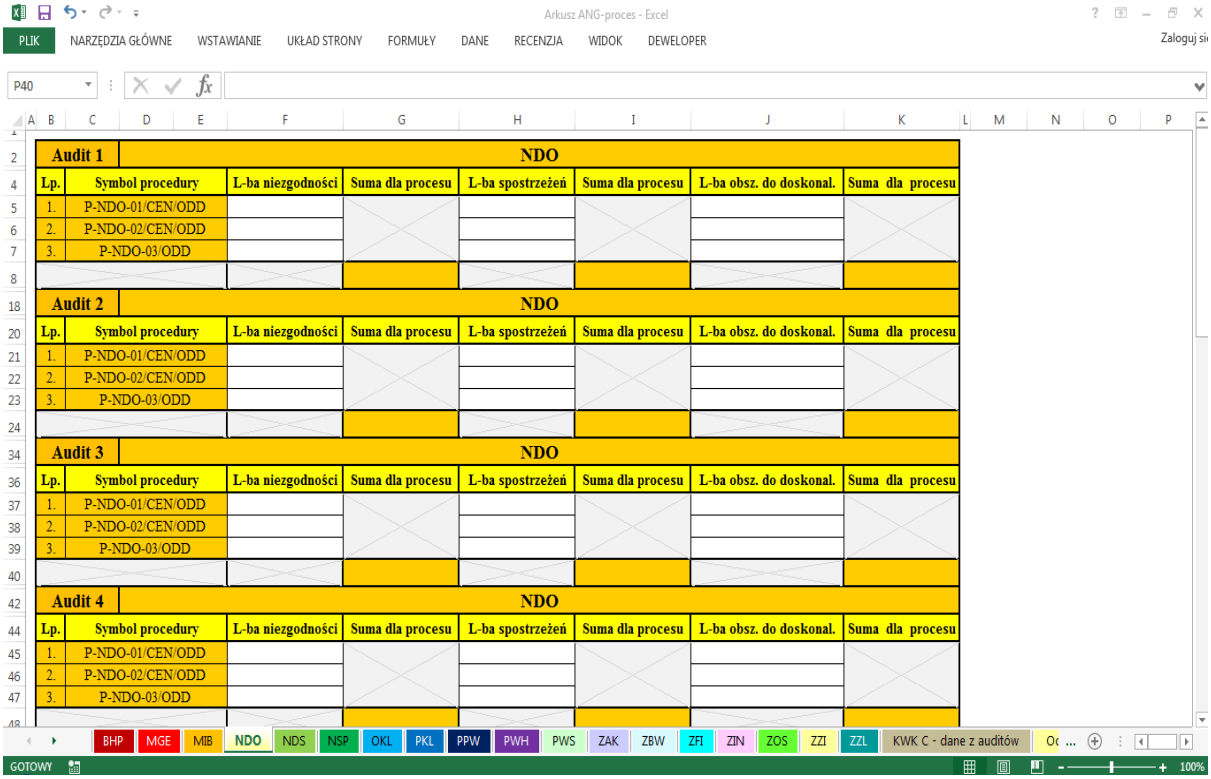

Figure8. *The "NDO" tab concerning the NDO process along with a list of procedures controlled in individual audits*

Source: *own elaboration*

Key:

L.p. = No.

Symbol procedury = procedure symbol

L-ba niezgodności = No. of non-conformances

Suma dla procesu = process total

L-ba spostrzeżeń = No. of observations

L-ba obsz. do doskonal. = No. of areas for improvement

The number of non-conformances, observations and areas for improvement identified in the audit is entered into the spaces next to process procedures. The sums of non-conformances, observations and areas for improvement are automatically copied to the "Data" and "KWK __ – audit data" tabs.

The same approach is applied to the entry of data, their summing up and automatic copying to the "KWK __ – audit data" tab.

Once all the data have been entered, the component scores of processes by non-conformances, observations and areas for improvement (the Process score by non-conformances, Process score by observations and Process score by areas for improvement tabs) and overall quarterly, half-year and annual scores for the given process will be calculated automatically.

The calculated scores are automatically saved in the "Data" tab (Figure 14). In this tab, after selecting options from drop-down lists, the user can obtain information on the selected period.

In the "**Year**" item, the user can select the calendar year. The tool has been prepared to cover the next 10 years. Another item is the "**Report Number in a given year**" where the user selects a subsequent audit number. The "**Reporting period**" concerns the period of time in which the report is to be generated. The possible options are: *month*, *quarter*, *half-year*, *year*. One should remember that if the user selects an option other than *month*, all non-conformances, observation and areas for improvement in the reporting period should be counted up. The next item is the "Number of audits in a reporting period" – if, for example, three audits were conduced in a reporting period, then "3" should be selected in the drop-down list.

The next two items are related to the audited processes and organisational units subject to audit. It is very often the case that several organisational units participate in one process. Taking into account the process approach, it is necessary to audit the process, i.e. all the organisational units which participate in it. This will allow to maintain a credible functioning score and process effectiveness.

The next two items are the "Number of non-conformances" and the "Number of observations" – these are populated automatically after the process tabs are filled, and are takes from the "KWK __ – audit data" tab, i.e. after entering the number of non-conformances, observations and areas for improvement for every procedure of the audited process(es).

Based on the calculated scores, a "Report on the effectiveness of the functioning of the integrated management system" is also generated automatically (Figure 15). It includes the most important information on the reporting period for which it is prepared and the scores of the processes audited in the reporting period and the branch score, which is the arithmetic mean of the scores for the individual procedures.

The practical example of scoring the effectiveness of IMS functioning is illustrated by an example of a branch of a mining enterprise (mine), in which the system covers 18 identified business processes. 2017 was selected as the reporting year. A total of 16 audits were conducted that year and included various processes ("ZZI", concerning the management of IT resources, was the only unaudited process).

The individual Figures 9-15 present the various tabs in the ANG-process sheet:

- Figure 9 – the tab of the "NDO" process concerning the supervision of documents with data from audit reports,
- Figure 10 – the "KWK __ – audit data" tab which is populated automatically after data concerning all the audited processes are entered,
- Figures 11-13 – the "Process score – observations", "Process score – non-conformances", "Process score – areas for improvement" tabs which are populated automatically,
- Figure 14 – the "Data" tab which includes a comprehensive summary of all data, populated automatically,
- Figure 15 – the "Annual report on the effectiveness of the functioning of the integrated management system" which includes annual IMS effectiveness score in relation to the individual processes and the entire branch.

Audit 1		NDO					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	1		0		0	
2.	P-NDO-02/CEN/ODD	0		1		0	
3.	P-NDO-03/ODD	0		0		0	
			1		1		0
Audit 3		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		1			
2.	P-NDO-02/CEN/ODD	0		3			
3.	P-NDO-03/ODD	0		0			
			0		4		0
Audit 5		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		2		0	
2.	P-NDO-02/CEN/ODD	0		5		0	
3.	P-NDO-03/ODD	0		0		0	
			0		7		0
Audit 6		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		2		1	
3.	P-NDO-03/ODD	0		0		0	
			0		2		1
Audit 7		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		1		0	
2.	P-NDO-02/CEN/ODD	0		2		0	
3.	P-NDO-03/ODD	0		0		0	
			0		3		0
Audit 8		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	2		0		0	
2.	P-NDO-02/CEN/ODD	0		0		0	
3.	P-NDO-03/ODD	0		0		0	
			2		0		0
Audit 9		**NDO**					
Lp.	Procedure symbol	L-ba niezgodności	Suma dla procesu	No. of observations	Process total	L-ba obsz. do doskonal.	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		0		0	
3.	P-NDO-03/ODD	0		0		0	
			0		0		0
Audit 10		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		2		0	
3.	P-NDO-03/ODD	0		0		0	
			0		2		0
Audit 11		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		2		0	
3.	P-NDO-03/ODD	0		0		0	
			0		2		0
Audit 12		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		3		0	
3.	P-NDO-03/ODD	0		0		0	
			0		3		0
Audit 13		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		0		0	
3.	P-NDO-03/ODD	0		0		0	
			0		0		0
Audit 15		**NDO**					
Lp.	Procedure symbol	o. of non-conformanc	Process total	No. of observations	Process total	No. of areas for improvemen	Process total
1.	P-NDO-01/CEN/ODD	0		0		0	
2.	P-NDO-02/CEN/ODD	0		0		0	
3.	P-NDO-03/ODD	0		0		0	
			0		0		0

Figure9. The "NDO" tab with audit data

Source: *own elaboration*

Audit year		2017															
Audit number in a year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of audited processes		3	3	4	3	4	6	4	3	3	5	3	3	4	2	3	2
Number of audited organisational units		1	2	4	4	3	4	2	2	1	6	7	1	2	2	1	1
Number of non-conformances	BHP	0		0		0	0	1	2	1		0	0		0		
	MGE				0												
	MIB															0	
	NDO	0		0		0	0	0	2	0	0	0	0	0		1	1
	NDS				0									1			
	NSP			0													
	OKL		0				0				0						
	PKL		0				0										
	PPW		1		0						0			0			
	PWH						0		0								
	PWS										1	0					
	ZAK					0		1									
	ZBW	0															
	ZFI																0
	ZIN										0						
	ZOS			0		0	0			0			1	0		0	
	ZZI																
	ZZL							0							1		
Number of observations	BHP	2		1		3	1	1	1	1		1	0		0		
	MGE				0												
	MIB															0	
	NDO	1		4		7	2	3	0	0	2	2	3	0		1	0
	NDS				1									1			
	NSP			2													
	OKL		0				1				1						
	PKL		0				0										
	PPW		0		1						0			1			
	PWH						2		0								
	PWS										1	0					
	ZAK					1		0									
	ZBW	2															
	ZFI																0
	ZIN										0						
	ZOS			1		1	0			0			0	0		0	
	ZZI																
	ZZL							2									
Number of areas for improvement	BHP	0		0		0	1	0	1	0		0	0		0		
	MGE				1												
	MIB															0	
	NDO	0		0		0	1	0	0	0	0	0	0	0		1	0
	NDS				1									0			
	NSP			0													
	OKL		0				1				1						
	PKL		0				0										
	PPW		1		0						0			0			
	PWH						0		0								
	PWS										0	0					
	ZAK					0		0									
	ZBW	0															
	ZFI																1
	ZIN										0						
	ZOS			0		0	0			0			1	0		0	
	ZZI																
	ZZL							0									

Figure10. *The "KWK __ – audit data" tab*

Source: *own elaboration.*

Process symbol	Process score in the audit – non-conformances																Quarterly score				Half-year score		Annual score
	1/2017	2/2017	3/2017	4/2017	5/2017	6/2017	7/2017	8/2017	9/2017	10/2017	11/2017	12/2017	13/2017	14/2017	15/2017	16/2017	Quarter 1	Quarter 2	Quarter 3	Quarter 3	Half-year 1	Half-year 2	Year
BHP	0,00		0,00		0,00	0,00	3,33	6,67	3,33		0,00	0,00		0,00			0,00	1,11	3,33	0,00	0,56	1,67	**1,11**
MGE				0,00													0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
MIB															0,00		0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
NDO	0,00		0,00		0,00	0,00	0,00	6,67	0,00	0,00	0,00	0,00	0,00		3,33	3,33	0,00	0,00	2,22	2,22	0,00	2,22	**1,11**
NDS				0,00									3,33				0,00	0,00	0,00	1,11	0,00	0,56	**0,28**
NSP			0,00														0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
OKL		0,00				0,00				0,00							0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PKL		0,00				0,00											0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PPW		3,33		0,00						0,00			0,00				1,11	0,00	0,00	0,00	0,56	0,00	**0,28**
PWH						0,00		0,00									0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PWS										3,33	0,00						0,00	0,00	1,11	0,00	0,00	0,56	**0,28**
ZAK					0,00		3,33										0,00	1,11	0,00	0,00	0,56	0,00	**0,28**
ZBW	0,00																0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZFI																0,00	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZIN										0,00							0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZOS			0,00		0,00	0,00			0,00			3,33	0,00		0,00		0,00	0,00	0,00	1,11	0,00	0,56	**0,28**
ZZI																	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZZL							0,00							3,33			0,00	0,00	0,00	1,11	0,00	0,56	**0,28**

Month	I	II	III	IV	V	VI	VI	VII	VII	VIII	X	X	XI	XII	XII	XII
Quarter	I			II			III				IV					
Half-year	Half-year 1						Half-year 2									
Year	2017															

Figure11. *The "Process score – non-conformances" tab*

Source: *own elaboration*

Process symbol	Process score in the audit – observations																Quarterly score				Half-year score		Annual score
	1/2017	2/2017	3/2017	4/2017	5/2017	6/2017	7/2017	8/2017	9/2017	10/2017	11/2017	12/2017	13/2017	14/2017	15/2017	16/2017	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Half-year 1	Half-year 2	Year
BHP	6,67		2,50		7,50	1,67	2,50	3,33	3,33		3,33	0,00		0,00			3,06	3,89	2,22	1,11	3,47	1,67	**2,57**
MGE				0,00													0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
MIB															0,00		0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
NDO	3,33		10,00		17,50	3,33	7,50	0,00	0,00	4,00	6,67	10,00	0,00		3,33	0,00	4,44	9,44	1,33	6,67	6,94	4,00	**5,47**
NDS				3,33									2,50				0,00	1,11	0,00	0,83	0,56	0,42	**0,49**
NSP			5,00														1,67	0,00	0,00	0,00	0,83	0,00	**0,42**
OKL		0,00				1,67				2,00							0,00	0,56	0,67	0,00	0,28	0,33	**0,31**
PKL		0,00				0,00											0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PPW		0,00		3,33						0,00			2,50				0,00	1,11	0,00	0,83	0,56	0,42	**0,49**
PWH						3,33		0,00									0,00	1,11	0,00	0,00	0,56	0,00	**0,28**
PWS										2,00	0,00						0,00	0,00	0,67	0,00	0,00	0,33	**0,17**
ZAK					2,50		0,00										0,00	0,83	0,00	0,00	0,42	0,00	**0,21**
ZBW	0,67																0,22	0,00	0,00	0,00	0,11	0,00	**0,06**
ZFI																0,00	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZIN										0,00							0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZOS			2,50		2,50	0,00			0,00			0,00	0,00		0,00		0,83	0,83	0,00	0,00	0,83	0,00	**0,42**
ZZI																	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZZL							5,00										0,00	1,67	0,00	0,00	0,83	0,00	**0,42**

Month	I	II	III	IV	V	VI	VI	VII	VII	VIII	X	X	XI	XII	XII	XII
Quarter	I			II				III			IV					
Half-year	I							II								
Year	2017															

Figure12. *The "Process score – observations" tab*

Source: *own elaboration*

Process symbol	Process score in the audit - areas for improvement																Quarterly score				Half-year score		Annual score
	1/2017	2/2017	3/2017	4/2017	5/2017	6/2017	7/2017	8/2017	9/2017	10/2017	11/2017	12/2017	13/2017	14/2017	15/2017	16/2017	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Half-year 1	Half-year 2	Year
BHP	0,00		0,00		0,00	3,33	0,00	3,33	0,00		0,00	0,00		0,00			0,00	1,11	1,11	0,00	0,56	0,56	**0,56**
MGE				3,33													0,00	1,11	0,00	0,00	0,56	0,00	**0,28**
MIB															0,00		0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
NDO	0,00		0,00		0,00	3,33	0,00	0,00	0,00	0,00	0,00	0,00	0,00		3,33	0,00	0,00	1,11	0,00	1,11	0,56	0,56	**0,56**
NDS				3,33									0,00				0,00	1,11	0,00	0,00	0,56	0,00	**0,28**
NSP			0,00														0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
OKL		0,00				3,33				3,33							0,00	1,11	1,11	0,00	0,56	0,56	**0,56**
PKL		0,00				0,00											0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PPW		3,33		0,00						0,00			0,00				1,11	0,00	0,00	0,00	0,56	0,00	**0,28**
PWH						0,00		0,00									0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
PWS										0,00	0,00						0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZAK					0,00		0,00										0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZBW	0,00																0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZFI																3,33	0,00	0,00	0,00	1,11	0,00	0,56	**0,28**
ZIN										0,00							0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZOS			0,00		0,00	0,00			0,00			3,33	0,00		0,00		0,00	0,00	0,00	1,11	0,00	0,56	**0,28**
ZZI																	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**
ZZL							0,00										0,00	0,00	0,00	0,00	0,00	0,00	**0,00**

Month	I	II	III	IV	V	VI	VI	VII	VII	VIII	X	X	XI	XII	XII	XII
Quarter	I			II				III			IV					
Half-year	Half-year 1							Half-year 2								
Year	2017															

Figure13. *The "Process score – areas for improvement" tab*

Source: *own elaboration*

Effectiveness of the functioning of the integrated management system	
Year	2017
Report number	1
Number of audits in the reporting period	16
Reporting period	Rok
Number of audited organisational units	43
Number of audited processes	17
Number of non-conformances	14
Number of observations	54
Number of areas for improvement	11

	Process symbol	Number of non-conformances	Number of observations	Number of areas for improvement	Score Q1	Score Q2	Score Q3	Score Q4	Score half-year 1	Score half-year 2	Annual score
Process score	BHP	4	11	2	6,11	11,22	14,56	2,22	8,67	8,39	8,53
	MGE	0	0	1		0,11			0,06		0,03
	MIB	0	0	0				0,00		0,00	0,00
	NDO	4	25	2	8,89	19,00	9,33	20,11	13,94	14,72	14,33
	NDS	1	2	1		2,33		5,00	1,17	2,50	1,83
	NSP	0	2	0	3,33				1,67		0,83
	OKL	0	2	2	0,00	1,22	1,44		0,61	0,72	0,67
	PKL	0	0	0	0,00	0,00			0,00		0,00
	PPW	1	2	1	3,44	2,22	0,00	1,67	2,83	0,83	1,83
	PWH	0	2	0		2,22	0,00		1,11	0,00	0,56
	PWS	1	1	0			4,67	0,00		2,33	1,17
	ZAK	1	1	0		5,00			2,50		1,25
	ZBW	0	2	0	0,44				0,22		0,11
	ZFI	0	0	1				0,11		0,06	0,03
	ZIN	0	0	0			0,00			0,00	0,00
	ZOS	1	2	1	1,67	1,67	0,00	3,44	1,67	1,72	1,69
	ZZI										
	ZZL	1	2	0		3,33			1,67		1,67
		14	54	11							

Figure14. *The "Data" tab*

Source: *own elaboration.*

Report

on the effectiveness of the functioning of the integrated management system

No. 1 / 2017

Reporting period	Rok
Number of audits conducted in the reporting period	16
Number of audited organisational units	43
Number of audited processes	17
Number of non-conformances	14
Number of observations	54
Number of areas for improvement	11

Process score		
	BHP	8,53
	MGE	0,03
	MIB	0,00
	NDO	14,33
	NDS	1,83
	NSP	0,83
	OKL	0,67
	PKL	0,00
	PPW	1,83
	PWH	0,56
	PWS	1,17
	ZAK	1,25
	ZBW	0,11
	ZFI	0,03
	ZIN	0,00
	ZOS	1,69
	ZZI	
	ZZL	1,67

IMS score for the Branch **2,03**

(signature of IMS Specialist)

Figure15. *The "Annual report on the effectiveness of the functioning of the integrated management system" tab*

Source: own elaboration.

4. SUMMARY

When the ANG-process sheet is used, the score, demonstrating the functioning of the integrated management system in the enterprise or its branch, is obtained based on the number of non-conformances, observations and areas for improvement identified during audits, taking into account the number of controlled processes. Importantly, the obtained score depends not only on the number of deficiencies found, but also the number of processes they concerned.

An additional advantage of the ANG-process sheet presented in the article it the possibility of generating periodical reports on the effectiveness of IMS functioning. This facilitates the comparison

between annual, half-year and quarterly scores obtained by various branches, allowing a quick determination where the system works correctly and where it should be improved, which is undoubtedly very important when it comes to its continuous improvement.

The presented methodology can be used by integrated management system specialists in organisational units. It is a proposed procedure to obtain information on the effectiveness of the functioning of all implemented systems (areas) forming the integrated management system [6].

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