ASSESSMENT OF THE REALIZATION QUALITY OF INITIAL TRAININGS (GENERAL INSTRUCTION) IN A COAL MINE

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Abstract: The paper presents the assessment of general initial trainings (general instruction) organized in two coal mines (KWK), accepting as the assessment criteria the quality of the delivered subjects structured within the training framework presented in the Annex 1 to the Regulation of the Minister of Economy, Labor and Social Policy on OHS trainings dated 27 July 2004. For calculation purposes, we applied one of the multicriteria assessment method – Promethee II in which the assessed criteria are maximized and the entities are compared pairwise with respect to the *i-th* criterion. To determine so called net flows, the function type No.4 was applied, which necessitated the determination of the indifference threshold q and the strict preference threshold p.

Keywords: the assessment of general initial trainings (general instruction), the multicriteria assessment method, the Promethee II method.

1 Introduction

The article One of relevant factors involving modern management styles is the training of working staff. It is viewed as a process aiming to accommodate the knowledge and skills of the employees to the requirements imposed by the organizational objectives and the method of their implementation [1]. The Regulation of the Minister of Economy, Labor and Social Policy dated 27 July 2004 on OHS trainings [6] provides detailed principles involving trainings on occupational health and safety, the scope of such trainings, requirements involving the subjects and the realization of training programs, the method of documenting the carried out trainings and the cases when the employers or employees can be exempted from the participation in certain specific trainings. Thus, the provisions of the said Regulation are implementing the regulations of the Directive 89/391/EWG dated 12 June 1989 [4].

Annex 1 to the above Regulation defines the framework of training programs, including also the initial, general trainings (general instruction) which have been designed for all people, who start their employment in a given company and which should be carried out before the employee starts work in a given company. The following subjects should be included in such trainings [6]:

- basic principles of the occupational health and safety,

- scope of the responsibilities and rights of the employer, employees and specific organizational units or social organizations of the company in terms of binding occupational health and safety regulations,
- liability for breaching the regulations or principles of the occupational health and safety,
- rules of safe movement within the premises of the company,
- accident hazards or health hazards which can occur within the premises of the company and general preventive measures,
- general OHS principles involving the use of technical tools and equipment as well as internal transport in the company,
- rules regulating the allotment of work clothes and boots as well as the means of individual protection, including also the workstation of the employees being trained,
- issues pertaining to order and cleanliness at workstations and their impact on the employees' health and safety,
- principles of the preventive medical care and its realization with respect to the workstation occupied by the trained employee,
- general principles of fire hazard protection and appropriate reaction in the event of fire,
- principles involving the reaction in the event of accidents, including the arrangement and administration of first aid.

The above scope of subjects should be covered within three school hours (3 x 45min).

2 Application of assessment subjectivity (individual preferences of the decision maker) in the decision-making process on the example of the method Promethee II

In the classical decision theory, the decision-making process is understood as a set of thinking or calculation processes logically related with one another, aiming to solve a decision-making problem by selecting one of possible variants of action to follow (decision), the best in the opinion of the decision maker. In a great majority of cases the selection of a solution usually comes down either to the choice of "the best" decision (in the opinion of the decision maker), or to the decisions are divided into classes of "equally good" decisions (satisfactory ones). The application of the assessment subjectivity (individual preferences of the decision maker) is illustrated by the method Promethee II which is one of so called discrete multicriteria methods. In this method the decision maker defines a finite set of decision-making variants (entities) from among which they want to extract a variant (entity) which in the best way corresponds with their preferences [2], [5]. In this method we investigate maximized criteria, and the particular decision-making variants (*a,b,c,...n*) are compared pairwise in terms of the *i-th* criterion. The preferences of the decision maker are determined on the basis of the obtained differences, i.e. preference functions are created, defined as the generalized criterion related to the *i-th* criterion. The values of the preferences are contained within the interval [0;1], with the value 1 (or close to 1) denoting strong preference of one variant as compared to the other, and the value 0 (or values close to 0) denoting very small preference. There are six types of generalized criteria commonly applied in practice [3], [5]:

- the criterion of function type No. 1

$$P_1(\delta) = \begin{cases} 0 & \delta \le 0 \\ 1 & \delta > 0 \end{cases} \quad (1)$$

- the criterion of function type No. 2

$$P_2(\delta)=\begin{cases}0 & \delta \le q\\ 1 & \delta > q\end{cases} \quad (2)$$

- the criterion of function type No. 3

$$P_3(\delta)=\begin{cases}0 & \delta \le 0\\ \delta/p & 0 < \delta \le p\\ 1 & \delta > p\end{cases} \quad (3)$$

- the criterion of function type No. 4

$$P_4(\delta)=\begin{cases}0 & \delta \le q\\ 1/2 & q < \delta \le p\\ 1 & \delta > p\end{cases} \quad (4)$$

- the criterion of function type No. 5

$$P_5(\delta)=\begin{cases}0 & \delta \le q\\ \dfrac{\delta-q}{p-q} & q < \delta \le p\\ 1 & \delta > p\end{cases} \quad (5)$$

- the criterion of function type No. 6

$$P_6(\delta)=\begin{cases}0 & \delta \le 0\\ 1-\exp\left(-\dfrac{\delta^2}{2s^2}\right) & \delta > 0\end{cases} \quad (6)$$

which are applied to define the following parameters [3], [5]:

- indifference threshold q – when for the investigated criterion the said threshold will be defined and δ_i *(a, b)* ≤ q_i, it means that the difference of assessments in terms of this criterion is too small for the decision maker to give preference to the higher value,
- strict preference threshold p - when for the investigated criterion the said threshold will be defined and δ_i *(a, b)* > q_i, it means that the difference of assessments in terms of this criterion is important enough for the decision maker to give preference to the variant *a* over the variant *b*,
- accepted (declared) parameter of the value between q and p *(s)*,
- difference between two decision-making variants with respect to the investigated criterion (δ).

Additionally, significance indexes w_i ($\sum_{i=1}^{n} w_i = 1$) are allocated to particular criteria.

3 Application of the method Promethee II in the assessment process – case study

To provide an example, the results of research studies carried out in the coal mines KWK1 and KWK2 were applied. The assessment process with the application of the accepted criteria involved the realization quality of the subjects delivered during the initial training (general instruction) defined in the training program, i.e.:

- criterion No.1 (f_1) *involved the assessment of the quality of the instruction provided on basic OHS principles*,
- criterion No.2 (f_2) *involved the assessment of the quality of the instruction provided on the scope of the responsibilities and rights of the employer, employees and specific organizational units or social organizations of the company in terms of binding occupational health and safety regulations*,

- criterion No.3 (f_3) *involved the assessment of the quality of the instruction provided on the liability for breaching the regulations or principles of the occupational health and safety*, etc.

The accepted range of assessment scale was from 1 (negative assessment, the lowest achievable one) to 10 (ideal assessment, the highest achievable one).

The significance of particular criteria was not being differentiated ($\boldsymbol{w_{1-11} = 0.091}$) .

The collected assessments of the entities in terms of the successive criteria are presented in Table 1.

Table 1. Collected assessments of the entities in terms of the accepted criteria

		Assessment criterion										
		f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9	f_{10}	f_{11}
Entity	KWK 1	6	4	8	6	9	8	8	5	5	8	4
	KWK 2	6	6	8	8	6	4	8	8	5	5	8

Using the criterion of function type No. 4 in the calculation part, the values of preference functions were determined assuming p=3 and q=1 (Table 2).

Table 2. Collected values of preference functions

δ_1	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0	0
δ_2	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0,5	0
δ_3	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0	0
δ_4	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0,5	0
δ_5	KWK 1	KWK 2
KWK 1	0	0,5
KWK 2	0	0
δ_6	KWK 1	KWK 2
KWK 1	0	1
KWK 2	0	0
δ_7	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0	0
δ_8	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0,5	0
δ_9	KWK 1	KWK 2
KWK 1	0	0
KWK 2	0	0
δ_{10}	KWK 1	KWK 2
KWK 1	0	0,5
KWK 2	0	0
δ_{11}	KWK 1	KWK 2
KWK 1	0	0
KWK 2	1	0

For both coal mines aggregated preference indexes were calculated:

$$\Pi(KWK1, KWK2) = \sum_{j=1}^{11} w_j P_j(KWK1, KWK2) \tag{7}$$

$$\Pi(KWK2, KWK1) = \sum_{j=1}^{11} w_j P_j(KWK2, KWK1) \tag{8}$$

and then positive and negative preference flows:

$$\Phi^{+}(KWK1) = \frac{1}{n-1} \sum_{y \in A} \prod (KWK1, KWK2) \tag{9}$$

$$\Phi^{-}(KWK1) = \frac{1}{n-1} \sum_{y \in A} \prod (KWK2, KWK1) \tag{10}$$

$$\Phi^{+}(KWK2) = \frac{1}{n-1} \sum_{y \in A} \prod (KWK2, KWK1) \tag{11}$$

$$\Phi^{-}(KWK2) = \frac{1}{n-1} \sum_{y \in A} \prod (KWK1, KWK2) \tag{12}$$

where n – number of entities subjected to the assessment.

In order to determine the final assessments (to build the final ranking), net flows were determined:

$$\Phi(KWK) = \Phi^{+}(KWK) - \Phi^{-}(KWK) \tag{13}$$

which had the following values respectively: -0.046 for KWK 1 and 0.046 for KWK 2.

Conclusion

The assessment results involving the realization quality of training subjects within the framework of general instruction can be treated in two ways: as final assessments (for each assessed entity), we obtain 11 so called single-criterion assessments, and as partial assessments, which allow us to determine so called net flows (aggregated final assessments).

Interpreting the research results as the results of single-criterion assessments we can state that:

- in the case of criteria No.1 (*the assessment of the quality of the instruction provided on basic OHS principles*), No.3 (*the assessment of the quality of the instruction provided on the liability for breaching the regulations or principles of the occupational health and safety*), No.7 (*the assessment of the quality of the instruction provided on the allotment of work clothes and boots as well as the means of individual protection, including also the workstation of the employees being trained*) and No.9 (*the assessment of the quality of the instruction provided on the principles of the preventive medical care and its realization with respect to the workstation occupied by the trained employee*) we found no differences in the realization quality of training subjects in the coal mines KWK1 and KWK2,
- in the case of criteria No. 5 (*the assessment of the quality of the instruction provided on accident hazards or health hazards which can occur within the premises of the company and general preventive measures*), No.6 (*the assessment of the quality of the instruction provided on general OHS principles involving the use of technical tools and equipment as well as internal transport in the company*) and No.10 (*the assessment of the quality of the instruction provided on general principles of fire hazard protection and appropriate reaction in the event of fire*) the realization quality of training subjects in the coal mine KWK1 was assessed higher,

- in the case of criterion No.2 (*the assessment of the quality of the instruction provided on the scope of the responsibilities and rights of the employer, employees and specific organizational units or social organizations of the company in terms of binding occupational health and safety regulations*), No.4 (*the assessment of the quality of the instruction provided on the rules of safe movement within the premises of the company*), No.8 (*the assessment of the quality of the instruction provided on the issues pertaining to order and cleanliness at workstations and their impact on the employees' health and safety*) and No.11 (*the assessment of the quality of the instruction provided on the principles involving the reaction in the event of accidents, including the arrangement and administration of first aid*) the realization quality of training subjects in the coal mine KWK2 was assessed higher.

To determine the aggregated assessment, we applied one of discrete multicriteria methods – PROMETHEE II. Basing on the determined with this method so called net flow values, we can state that with the accepted assessment criteria (preference function type No. 4, q=1, p=3) higher realization quality of general initial trainings (general instruction) was found in the case of KWK2 $\left(\Phi(KWK\ 2) = 0.046\right)$.

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OCENA JAKOŚCI REALIZACJI SZKOLEŃ WSTĘPNYCH OGÓLNYCH (INSTRUKTAŻU OGÓLNEGO) W KWK

Abstrakt (Streszczenie): W artykule poddano ocenie szkolenia wstępne ogólne (instruktaż ogólny) realizowane w dwóch kopalniach węgla kamiennego (KWK), przyjmując jako kryteria oceny jakość realizacji tematów zdefiniowanych w ramowym programie szkoleń zawartym w zał. nr 1 do Rozporządzenia Ministra Gospodarki i Pracy z dnia 27 lipca 2004 r. w sprawie szkolenia w dziedzinie bhp. W warstwie obliczeniowej wykorzystana została jedna z metod oceny wielokryterialnej – metoda Promethee II, w której oceniane kryteria są maksymalizowane, a obiekty porównywane parami ze względu na i – te kryterium. W celu wyznaczenia tzw. przepływów netto wykorzystany został typ 4 funkcji, co wymagało zdefiniowania wartości progu indyferencji q oraz progu ścisłej preferencji p.

Klíčová slova (Słowa kluczowe): szkolenia wstępne ogólne (instruktaż ogólny), ocena wielokryterialna, metoda Promethee II.