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SUPERVISORS COMPETENCE AND SAFETY LEVEL IN COAL MINES

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ABSTRACT

Purpose	Both, theorists and practitioners of management emphasize that staff competence increasingly influences the proper operation of modern enterprises. This is significant not only when acquiring satisfactory work efficiency, but in connection to the required level of safety.
Methods	The aim of the research presented in this article is to determine essential issues in the area of underground coal mines supervisors (middle level managers) with regard to the safety level in coal mines. The research methods include survey, PAPI technique (Paper-and-Pencil-Interviewing) and a questionnaire. Supervisors from three mines participated in the research. The sample test was conducted deliberately, using a proportional scheme including the position in the supervisory department and the department type.
Results	Analysis of the results allowed for the evaluation of the twelve sub-categories of supervisors competence and knowledge level and their impact on the effectiveness of the maintenance of security. Moreover, the correlation between the determined level of separate competence sub-categories and their influence on the level of safety enabled the prioritization of the level of a lack of competence in reference to proper work safety maintenance.
Practical implications	The knowledge acquired on supervisors competence is to be applied to the prevention programme as a part of the following programme: "Methods of diagnosis and reduction programme of adverse effects related to the underground use of technical means..." (PBS, NCBiR No 1519/2012).
Originality/ value	The theoretical section of the article includes the original definition and competence model, as well as a model of competence impact on the safety level in an enterprise. The approach to the research problem is also valuable – the issues of underground coal mines supervisors competence have been for the first time directly connected with the underground safety level.

Keywords
competence, safety, supervisors

1. PROFESSIONAL COMPETENCE – MEANING, TYPES OF COMPETENCE

The growth in popularity of the concept of *competence* started in 1973, when McClelland published an article entitled *Testing for Competence Rather than for Intelligence* that focused on the predominant role of competence over intelligence and knowledge in achieving professional success. The author, without precisely defining the term competence, drew attention to the fact that knowledge and intelligence tests as well as certificates do not allow for the accurate prediction of careers. According to his approach, the author pointed to the need to define the criteria for satisfactory performance and expressed an the view that "in order to determine who will be a good police officer, we need to find out what a good police officer does" (McClelland, 1973, p. 7).

Currently, the term professional competence is used commonly in everyday language and is intuitively understood as a set of an employee's characteristics that determine the efficiency of his work in different professional situations. In the academic sphere, the concept is ambiguous or even in definitional chaos. The thesis is confirmed by a multitude of definitions that differ not only in degree of detail, but also – creating methodological difficulties – the content of substantive findings.

As a consequence, the following question should be asked: what is professional competence? The analysis of the definitions and concepts presented in specialist literature indicates the existence of a great diversity of views concerning this subject. There can be various understanding of this term: the sum of components (Juchnowicz, 2002), a set of a person's characteristics (Whiddett & Hollyforde, 2003), a set of dispositions in the specified range (Filipowicz, 2004, 2008), a capability (Thierry, Sauret, & Monod, 1994), an ability (Denst-Sadura, 2013), generally sustainable qualities of a man (Pocztowski, 2003), a set of behaviors (Levy-Leboyer, 2007) or the potential of an individual (Męczkowska, 2003; Boyatzis, 1982 – quote after Juchnowicz, 2002; Armstrong, 2005).

In addition; what elements is the concept of professional competence comprised of? Components such as knowledge and skills are the only ones that are not doubted (Czarnecki, 2006). The others are characterized by great diversity. The following are frequently mentioned – amongst others: an attitude (Filipowicz, 2004; Thierry, Sauret, & Monod, 1994), motivation (Whiddett & Hollyforde, 2003; Juchnowicz, 2002), personality traits (Whiddett & Hollyforde, 2003; Levy-Leboyer, 2007), as well as: self-esteem associated with the functioning of the group (Whiddett & Hollyforde, 2003), abilities (Denst-Sadura, 2013) ambitions, core values, ways of performance (Rostowski, 2004), typical behavior, ways of reasoning (Levy-Leboyer, 2007), perceptions of oneself, social roles (Juchnowicz, 2002).

Classifications of competence presented in the specialist literature have a similar range of diversity, covering both their categories and sub-categories or types, and often contains dozens to even hundreds of items. Examples of the above mentioned categories are:

- the division of competence: professional, social, personal and managerial presented in the publication entitled "Universal competency model. User's Manual", prepared by the Management Observatory Foundation in cooperation with the Competency Institute,
- two categories of competence identified by the G. Filipowicz (2004) – base, including: cognitive, social, personal, as well as executive: business, corporate and managerial type,
- three categories mentioned by M. Armstrong (2005) – general and specific, threshold and performance, and differentiating,
- three categories identified by T. Rostowski (2004): key, specific functions and a specific role,
- two categories defined by J. Kubicka-Daab (2001): functional and behavioral,
- two subsets of competence: general, including managerial and technical, determined by Rothwell, Hohne, and King (2000),
- four categories adopted by T.P. Czapla (2012): leadership, general, technical and personality traits.

Theorists and researchers dealing with the issue of professional competence, however, agree on the need to include the subject's behavioral aspect. This fact leads to the conclusion that the determinants of behavior undertaken in the workplace need deeper analysis, being a multiplicative function of ability (organizational and symptoms) and motivation (Martyka, 2013). This assertion results from the social model of human functioning by A. Bandura (2007), recognizing the triad of mutual (two-way) causality between: features of an individual, characteristics of the environment and behavior (Fig. 1).

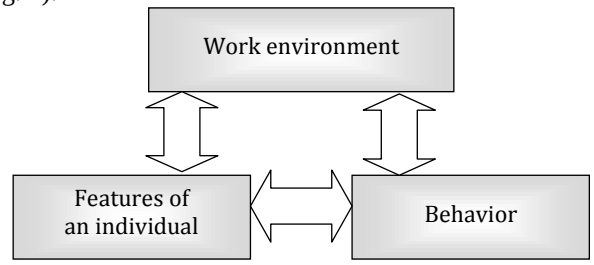

Fig. 1. Social model of human functioning by A. Bandura (2007)

Thus, **competence can be defined as a multiplicative function of subjective human capabilities in the field of efficient, effective and safe performance of tasks and the motivation to make full use of these opportunities in the workplace, where the capacity and motivation are considered in the context of its role as a professional and physical characteristics and organizational environment** (Fig. 2).

The classification of competence has adopted division into three categories: professional, social and personal.

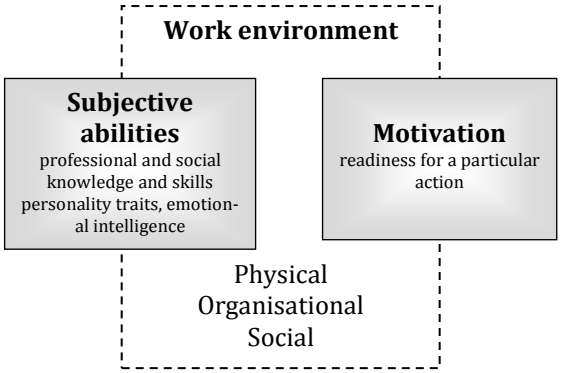

Fig. 2. Competence model (own elaboration)

The function used in the definition and described as multiplicative, means that in order to achieve the desired result (professional behavior) it is necessary to simultaneously demonstrate the necessary opportunities and symptoms of motivation to engage in behavior which guarantees a certain level of performance. Thus, a person characterized by a high capacity, but without motivation strong enough, will not behave in a desired way, and simultaneously, strong motivation not supported by adequate capacity will not allow for the achievement of high efficiency.

Two terms included in the definition require further comment: motivation and subjective capabilities. The first is an internal process conditioning the unit to strive to achieve the objective (Reykowski, 1978). In other words, it is man's state of readiness for a particular action. The second term, subjective capabilities, is the characteristics of an individual, taking into account his or her desirable properties due to the implementation of company objectives and bench tasks, including: knowledge and expertise, specialist/professional skills, social skills, emotional intelligence and personality traits.

Is it possible to draw up a detailed list of the types of competences to guarantee success in a given position in an enterprise? It seems to be a relatively difficult task, because the number of types of high competence at an individual level cannot decide by the level of professionalism, but their appropriate configuration consisting of a specific set of types of competences to a level appropriate to the task and the conditions under which it is implemented influence the level of professionalism. This set will allow a synergistic effect to be obtained and consequently will enable a high level of performance.

2. COMPETENCE AND WORK SAFETY

The belief that competence significantly influences the state of safety in an enterprise is common. The obvious elements of competence are the hardest to demonstrate and prove. This may be the reason for the lack of research that

would show a direct relationship between different configuration categories, or types of competence of a safe operation. The following figure (Fig. 3) shows a theoretical model of the effects highlighted in the definition of the components of professional competence at a safety level. It was assumed that this impact will be visible on at least three levels of action.

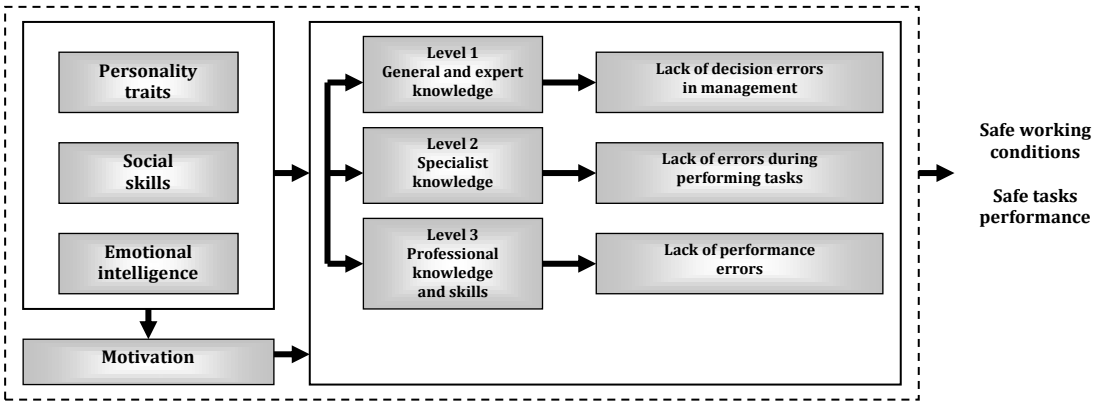

Fig. 3. Theoretical model of the effects highlighted in the definition of the competence components of safety level in an enterprise (own elboration)

Level 1

General knowledge of the mechanisms governing reality with the expertise that allows the right decision to be made in a new, challenging or vague situation. Knowledge in this area is essential for the development of new procedures and rules of conduct, which increase the safety level (none or rare errors in management decisions – hidden errors).

Level 2

The professional knowledge, including performance standards that condition the elimination (restriction) of errors resulting from the inadequate assessment of the task situation, including risk assessment (none or rare decision errors during performance).

Level 3

Professional knowledge and skills that ensure the efficient and effective implementation of standard tasks – well-known in a particular situation; imply a lack or limitation of active faults (executive), determining the safety of the workplace.

Additional conditions affecting professionalism in each of the levels of action are:

1. Motivation – determines the willingness to use general knowledge, professional knowledge and professional skills. In addition, it determines the development of knowledge and skills.
2. Social skills with emotional intelligence – imply good communication, cooperation, lack of conflicts, etc., which together constitute a good working atmosphere (no or rare errors caused by unfavorable social environment of the workplace, including stress, frustration).
3. Personality traits – a study of the extended features of personality characteristics of the situation shown, for example, the relationship of conduct safety level with: activation and sensitivity determining the need for stimulation (Strelau, 1985), the level of anxiety, understood as a relatively stable personality trait (Ratajczak, 1992; Reykowski, 1979), the style of cognitive control determining the specific way of perceiving the world and influencing the perception of the risks and, consequently, the size of the risk accepted by an individual (Strelau, 1985), and level of aspiration, which determines the strength of motivation for achievements and sets out a strategy for undertaken activities (Studenski, 1996; Nosal, 1993).

3. THE EFFECT OF COMPETENCE ON THE SAFETY LEVEL ACCORDING TO UNDERGROUND COAL MINES SUPERVISORS

The diagnosis of technical risk activation in underground coal mines (Work subcontracted, 2011) showed that one of the main reasons for the difficulties of supervisors in the implementation of its activities affecting the safety situation is an insufficient level of competence. Moreover, it is noted and highlighted not only by the supervisors themselves, but also observed by their subordinates. At the same time the supervisors pointed to the shortcomings of workers' (blue collar) competence as the cause of error regulations and knowingly assumed risk.

The level of underground coal mines employees' competence can therefore be considered as one of the essential determinants of the safety situation which causes issues, both for supervisors and workers.

3.1. Purpose and scope of the research

The aim of the research presented in this article is to determine essential issues in the area of underground coal mines supervisors with regard to the safety level in coal mines.

This objective has been divided into three specific objectives, i.e.:

a) to determine the level of individual competence sub-categories of supervisors (higher, middle and lower level)[1],
b) to recognize the degree of influence of each competence sub-category on undertaken actions in relation to the maintenance of safety,
c) to link the current level of individual competence sub-categories of supervisors with their degree of impact on the maintenance of the safety level.

The following aspects were included in the list of sub-competences relevant to the position held in a supervisory

[1]In Polish coal mines underground supervisors is divided on three levels: higher, middle, lower.

department in coal mines (after consulting the experts from KW SA and specialists from three mines):

1. Professional knowledge necessary for the proper execution of tasks
2. General knowledge of safety and safety management
3. Knowledge of regulations, procedures and instructions in the field of occupational safety
4. Knowledge and understanding of documentation and changes in documentation
5. Professional skills (technical and other tasks related to implementation)
6. Analytical and conceptual skills (decision making, problem solving, proper assessment of the situation – the ability to see the interrelationships between the various factors of the situation so that the measures taken are effective and safe)
7. Organizational skills (efficiency, planning, division of labor, delegation, coordination)
8. Interpersonal skills (ability to work with people, understanding their motivation, etc.)
9. The ability to transfer knowledge and instruction to subordinate workers – comprehensible formulation of thoughts and oral and written orders
10. Commitment (motivation)
11. Personality traits: readiness to change, accountability, consistency.

3.2. Research methodology

The method, technique and research tool

The study used a survey, considered the best available method for collecting original data for describing a population too large to be observed directly, the PAPI technique (Paper-and-Pencil-Interviewing) is a survey technique. A traditional method used for surveying that involves respondents filling out a physical paper questionnaire that had been administered by an interviewer.

There research included a questionnaire that covered predetermined sub-categories of competence. Respondents assessed the level of the sub-categories in higher, middle and lower level supervisors on a scale from 1 – very low, to 5 – very high, as well as the degree of influence of each sub-category on the safety level: 1 – no impact, 2 – negligible impact, 3 – significant impact. In addition, respondents decided on the range of required knowledge that should increase on every supervisors level, and the necessary skills required for improvement.

A preliminary version of the research tool was subjected to verification in pilot studies, attended by experts from the Central Mining Institute, the KOMAG Mining Institute, Kompania Węglowa SA, departmental coordinators of three mines, as well as supervisors of mines from different mining companies. This part of the pilot studies was carried out during training sessions and workshops organized in the Central Mining Institute. The study involved 23 supervisors. Expert and specialist opinions were obtained primarily using the technique of *brainstorming* during meetings or consultations.

3.3. Sample selection, organization and execution of the research

The decision regarding the selection of the sample, resulted from the nature of the planned research. Recognition of the competence level of underground coal mines supervisors was one of the elements of extensive research on organizational and competence influence on safety conditions. The completion of the prepared questionnaires by the respondents required a considerable amount of time and work. Therefore, it was assumed that the sample should be selected in a targeted manner in the proportionate schema, taking into account the position held and type of department (mining, preparatory works and electrical power and mechanical systems). Consequently, the study included 30 supervisory workers from three selected mines – a total of 90 people.

The study of middle and lower level supervisors was carried out during training sessions organized in the Central Mining Institute in September 2013 – in four groups of 18 people. The course discussed several issues providing the basic knowledge of social determinants of work safety. The chosen form enabled the provision of detailed instructions and explanation of the problems. The higher level supervisors fill out the questionnaire alone.

3.4. Results

These studies involved 89 supervisors, including 12 higher level supervisors, 39 – middle level supervisors and 38 lower level supervisors. Respondents were employees from three departments: exploitation (31 workers), electrical power and mechanical systems (27 workers) and preparatory (26 workers). Five respondents did not provide information about their department.

Analysis of the research results made it possible to recognize the opinions of supervisors in the scope of:

1) the current level of individual competence sub-categories for higher, middle and lower level supervisors,
2) the degree of influence of each competence sub-category on the safety level.

Due to the lack of the possibility to present the results of the whole empirical material, the article is limited to the presentation of the most relevant issues due to the adopted objective which is an indication of the problem areas, i.e. those sub-competences of supervisors where the level is low and average and it significantly impacts the safety situation. The three tables contain the following data:

1. The percentage of respondents assessing the influence of the individual competence sub-category on safety as significant – table 1.
2. The percentage of respondents assessing the individual competence sub-category as not higher than average (very low, low and average) – table 2.
3. The importance of the problem determined according to the following course of action – table 3.

Assessment of the problem in the area of competence:

A. The percentage of respondents assessing the specific competence sub-category as not higher than average (very low, low and average).

Percentage	Level of competence	Color code
up to 20%	1 (very high)	yellow
over 40%	2 (high)	yellow
over 40 to 60%	3 (average)	green
over 60 to 80%	4 (low)	red
over 80 to 100%	5 (very low)	red

B. The percentage of respondents confirming the influence of an individual competence sub-category on the safety.

Percentage	Level of influence	Color code
up to 20%	1 (very low)	yellow
over 20 to 40%	2 (low)	yellow
over 40 to 60%	3 (average)	green
over 60 to 80%	4 (high)	red
over 80 to 100%	5 (very high)	red

C. Scale of the problem – assessment of a matrix of the level of each sub-category and its impact on the safety level (values from 1 to 25).
blue: marginal problem
yellow: perceptible/noticeable problem
green: significant problem
red: key issue

	Effect				
Frequency	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

3.5. Supervisors competence and safety level

Each of the twelve sub-categories of competence was assessed by supervisors in terms of the impact on the maintenance of the safety level in underground mines – by determining whether the impact is significant, negligible, or, generally, it does not occur.

The percentage indicating a lack of influence of individual sub-competences of supervisors at all levels (higher, middle, lower) on the safety level ranged from 3.4 to 15.7%, while the percentage of those recognizing the impact as negligible – ranged from 18.0 to 47.2%. The sub-categories of competence of supervisors at each level that are characterized by the lack of impact on the safety situation and negligible impact – according to the responders – are: openness to change and interpersonal skills.

The types of competence that have a significant impact on the safety level (from 60.7 to 76.4% of responses) and required for each level of supervisors include: professional knowledge necessary for the proper execution of tasks, general knowledge of safety and safety management, and the ability to transfer knowledge and instruction to subordinate employees. Higher and middle level supervisors should additionally possess the following skills: analytical and conceptual skills (decision making, problem solving, proper assessment of the situation) and organizational skills (efficiency, planning, division of labour, delegation, coordination), as well as good knowledge of the rules, procedures and instructions in the field of safety. For the middle and lower level supervisors essential professional skills (technical and other skills related to the implementation) are essential, moreover, competence is significant for the middle level supervisors. The figures are presented in Table 1.

The largest difference in responses – on the effect of individual sub-categories of competence of supervisors to maintain a higher level of safety – was recorded for the L sub-category – accountability, consistency (SD^2 = 0.5429) and J – openness to change (SD_2 = 0.5120), while the smallest was for the A sub-category – the professional knowledge necessary for the proper execution of tasks (SD^2 = 0.2674).

Table 1. Evaluation of the impact of individual sub-categories competence on the safety level – according to the position held (N = 89)

Sub-categories of supervisors competence	Percentage of respondents assessing the influence of an individual competence sub-category on the safety as significant, depending on the position held		
	high-level supervisor	mid-level supervisor	low-level supervisor
A. Professional knowledge necessary for the proper execution of tasks	76.4%	73.0%	65.2%
B. General knowledge of safety and safety management	69.7%	68.5%	61.8%
C. Knowledge of regulations, procedures and instructions in the field of occupational safety	67.4%	61.8%	55.1%
D. Knowledge and understanding of the documentation and changes in documentation	57.3%	52.8%	52.8%
E. The ability to transfer knowledge and instruction to subordinate workers	62.9%	65.2%	61.8%
F. Professional skills (technical and other tasks related to the implementation)	59.6%	61.8%	62.9%
G. Analytical and conceptual skills (decision making, problem solving, proper assessment of the situation – the ability to see the interrelationships between the various factors of the situation, so that the measures taken are effective and safe)	70.8%	62.9%	57.3%
H. Organizational skills (efficiency, planning, division of labor, delegation, coordination)	67.4%	62.9%	55.1%
I. Interpersonal skills (ability to work with people, understanding their motivation, etc.)	56.2%	51.7%	52.8%
J. Readiness for changes – the ability to introduce new solutions	41.6%	48.3%	47.7%
K. Involvement in the implementation of tasks	49.4%	46.6%	44.9%
L. Responsibility, consistency	57.3%	60.7%	50.6%

4th and 5th degrees of influence are marked in red. This means that over 60% of respondents rated the impact of the sub-categories of competence on the safety level as significant. The 3rd degree of influence is marked in green – the influence of the sub-category of competence on the safety level was rated significant by more than 40 to 60% of the respondents.

The value of variance for the impact assessment of each sub-category of competence of the middle level supervisors to maintain the safety level, ranges from 0.3384 to 0.4596. The largest concerns the L sub-category (accountability, consistency), while the smallest – the C sub-category (knowledge of the rules, procedures and instructions in the field of safety at work) and F (professional skills), and for lower level supervisors the value of the variance is between 0.3384 (sub-category B – general knowledge in the field of safety and safety management) to 0.4333 (L – accountability, consistency).

Underground coal mines supervisors also assessed the level of each sub-category of their own competence on the scale: very low, low, average, high and very high. Data covering the assessment of very low to average (total percentage) is included in Table 2.

The results show that none of the sub-categories of competence of higher, middle and lower level supervisors were ranked as very low or low (level 4 and 5). In contrast, the results of the analysis suggest that the competence of lower level supervisors were rated, relatively, quite negatively. Each of the twelve sub-categories was ranked at level 3, which means that it was assessed at most between an average of 40% to 60% of the respondents. Moreover, three sub-categories of competence were ranked as very low or low (about 20%): professional skills, analytical and conceptual skills, and professional knowledge. Only two sub-categories within the low and very low range exceeded 10% (openness to change and commitment to a task).

The competence of higher and middle level supervisors in comparison with the lower level supervisors is ranked as higher – the level 3 concerns only seven of the sub-categories.

Table 2. Scale of problems in the area of competence of each sub-category – according to the position held (N = 89)

Sub-categories of supervisors competence	Scale of the problem degree of influence of x competence level		
	high-level supervisor	mid-level supervisor	low-level supervisor
A. Professional knowledge necessary for the proper execution of tasks	32.6%	37.1%	48.3%
B. General knowledge of safety and safety management	36.0%	39.3%	49.4%
C. Knowledge of regulations, procedures and instructions in the field of occupational safety	33.7%	47.2%	50.6%
D. Knowledge and understanding of the documentation and changes in documentation	40.4%	52.8%	52.8%
E. The ability to transfer knowledge and instruction to subordinate workers – comprehensible formulation of thoughts and oral and written orders	50.6%	40.4%	53.9%
F. Professional skills (technical and other related to the implementation)	38.2%	41.6%	51.7%
G. Analytical and conceptual skills	47.2%	47.2%	56.2%
H. Organizational skills (efficiency, planning, division of labour, delegation, coordination)	38.2%	34.8%	50.6%
I. Interpersonal skills (ability to work with people, understanding their motivation, etc.)	55.1%	41.6%	55.1%
J. Readiness for changes – the ability to introduce new solutions	60.7%	46.1%	53.9%
K. Involvement in the implementation of tasks	44.9%	33.7%	43.8%
L. Responsibility, consistency	40.4%	28.1%	46.1%

The 4th and 5th levels of competence are marked in red (over 60% of respondents assessed the level of this particular sub-category as average at best). The 3rd level is marked in green (more than 40 to 60% of respondents ranked the sub-category of competence as average at best).

The sub-categories of middle level supervisors were assessed as average in most cases (over 45%): knowledge and understanding of documentation and changes in documentation (52.8%), knowledge of the rules, procedures and instructions in the field of safety at work (47.2%), analytical and conceptual skills (47.2%), and openness to change (46.1%). The percentage of very low and low did not exceed 10% for any of the established sub-categories of competence for middle level supervisors.

The most critically rated sub-categories of competence of higher level supervisors are: openness to change (60.7% rated average at best), interpersonal skills (55.1%) and the ability to transfer knowledge and instructions to subordinate employees (50.6%). Moreover, three sub-categories were assesses as very low and low by a high percentage of the responders: interpersonal skills (15.7%) and personality traits, i.e., openness to change (19.1%), and accountability and consistency (18.0%).

As a conclusion of the results presented in this paper it should be emphasized that each level of supervisors received relatively low ratings (not more then average in the 40–60% of respondents) in five of the sub-categories of competence: knowledge (knowledge and understanding of documentation and changes in documentation), personality traits (openness to change), and three types of skills (interpersonal, analytical, conceptual, and the transfer of knowledge and instructions to subordinate employees).

The largest difference in the ratings of the individual sub-categories of competence for higher level supervisors was recorded for the L sub-category – accountability and consistency (SD^2 = 1.1890) and the J sub-category – openness to change (SD_2 = 0.9592), while the smallest was recorded for the A sub-category – professional knowledge necessary for the proper execution of tasks (SD^2 = 0.4794).

The value of variance for the assessment of each of the competence sub-categories of middle level supervisors ranges from 0.3899 to 0.5784. The highest concerns the J sub-category (openess to change), while the lowest – the D sub-category (knowledge of documentation and changes in documentation), and for lower level supervisors the value of the variance is from 0.4629 (B sub-category – general knowledge in the field of safety and safety management) to 0.7249 (G – analytical and conceptual skills).

The results of studies carried out in three coal mines, in total, – as presented in Table 3 – suggest that the key problems in the area of supervisors competence include:

- supervisors of each level – the ability to transfer knowledge and instructions to subordinate workers – comprehensible formulation of thoughts and oral and written orders,
- higher and middle level supervisors – analytical and conceptual skills (decision making, problem solving, proper assessment of the situation – the ability to see the interrelationships between various factors of a situation so that the measures taken are effective and safe),
- higher and lower level supervisors, abovementioned and readiness for changes,
- middle level supervisors, above mentioned: knowledge of regulations, procedures and instructions in the field of occupational safety,
- lower level supervisors, abovementioned: the professional knowledge necessary for the proper execution of tasks, general knowledge of safety and safety management, professional skills (technical and other tasks related to the implementation), commitment to the task.

Table 3. Importance level of the problems in the area of competence of each sub-category – according to position held (N = 89)

Sub-categories of supervisors competence	Scale of a problem degree of influence of x competence level		
	high-level supervisor	mid-level supervisor	low-level supervisor
A. Professional knowledge necessary for the proper execution of tasks	8	8	12
B. General knowledge of safety and safety management	8	8	12
C. Knowledge of regulations, procedures and instructions in the field of occupational safety	8	12	9
D. Knowledge and understanding of documentation and changes in documentation	9	9	9
E. The ability to transfer knowledge and instruction to subordinate workers – comprehensible formulation of thoughts and oral and written orders	12	12	12
F. Professional skills (technical and other related to the implementation)	6	9	12
G. Analytical and conceptual skills	12	12	9
H. Organizational skills (efficiency, planning, division of labor, delegation, coordination)	8	8	9
I. Interpersonal skills (ability to work with people, understanding their motivation, etc.)	9	9	9
J. Readiness for changes – the ability to introduce new solutions	12	9	12
K. Involvement in the implementation of tasks	9	6	12
L. Responsibility, consistency	9	6	9

The color red indicates the key issues, and green – significant.

The data presented in Table 3 shows that the biggest gaps in competence that can be described as key problems relate to lower level supervisors, as they were noticed in six of the sub-categories of competence. Such gaps were recognized in three sub-categories in the case of middle and higher level supervisors. Furthermore, it should be emphasized that the

lack of competence (the key issue) pointed out in all three levels of supervisors refer to the categories that are essential for each level of supervision, because of the efficiency and effectiveness of the implementation of the tasks, as well as the maintenance of safety (higher and middle level – analytical and conceptual skills, the ability to transfer knowledge and instruction; lower level – professional skills, professional knowledge, knowledge and the ability to communicate instructions and motivation).

In terms of gaps in knowledge and skills the research did not indicate such a broad range of study material as had been expected in the context of the deficiencies identified in various sub-categories of competence. Respondents answering the question about the skills and knowledge that should be increased too frequently copied the content of sub-categories listed in the questionnaire. Gathered interviewees are shown in Table 4.

Table 4. The knowledge and skills that are required to increase according to supervisors

Deficiencies in respect to the competence	High-level supervisor	Mid-level supervisor	Low-level supervisor
KNOWLEDGE	1	2	3
Knowledge of machines and the equipment's maintenance manual	x	x	x
Knowledge of principles of electrical equipment operation		x	x
Knowledge of work technology		x	x
Knowledge of the operation, maintenance, repair, troubleshooting and servicing of mining equipment		x	x
Better knowledge of the parameters of machines and devices operating in the region to allow appropriate selection of spare parts		x	x
Knowledge of procedure in case of failure	x		
Knowledge of work carried out in the department	x		
Knowledge of work undertaken in other departments (in addition to own)	x		
Knowledge of the layout of the machinery in excavations	x		
Knowledge of the latest technology	x		
Knowledge of performance methods of particularly dangerous tasks		x	
Knowledge of electrical power and mechanical equipment		x	
Knowledge of technical parameters of transport systems		x	
Knowledge of motivation (ways to motivate employees)		x	
Psychological knowledge in the field of cooperation		x	
Knowledge of risks and ways of solving them			x
Knowledge and understanding of documentation (technical projects)			x
Knowledge of the general provisions concerning supervisory competence in coal mines			x
SKILLS			
A. Professional/specialist	1	2	3
The ability to perform mining operations in compliance with mining regulations	x	x	x
The ability to solve practical engineering problems	x	x	
The ability to accelerate the use of the technical documentation	x		
Technical Skills		x	
The sbility to conduct bench trainings		x	
The ability to predict the occurrence of a fault in a device			x
The ability to apply theoretical knowledge in practice			x
B. Leadership/management	1	2	3
The ability to make fast decisions	x	x	x
The ability to plan and organize work	x	x	x
The ability to properly assess the situation	x	x	x
The ability to coordinate the work	x	x	
The ability to manage time using the knowledge of the time required to perform a commissioned work	x	x	
The ability to solve problems		x	x
The ability to motivate staff		x	x
The ability to designate employees career path and advise in this regard	x		
The ability to manage a department	x		
The ability to think ahead	x		
The ability to manage the team		x	
The ability to predict and draw conclusions		x	
The ability to plan the division of responsibilities		x	
The ability to coordinate the work of a team			x
The ability to select the right people to perform specific work			x
The ability to supervise ongoing works			x
The ability to coordinate the work of a team			x
C. Interpersonal communication	1	2	3
The ability to provide comprehensive information	x	x	x
The ability to transfer knowledge	x	x	x
Faster transmission of information		x	x
Listening skills	x		
The ability to discuss a problem	x		
The ability to explain the reason of a task		x	
The ability to establish good contact with subordinates		x	
The ability to communicate with superiors			x
The ability to establish a dialogue with subordinates			x
D. Other interpersonal skills	1	2	3
The ability to cooperate (with superiors, subordinates, colleagues)	x	x	x
The ability to cope with stressful situations – stress mitigation	x	x	
The ability to optimize the use of the experience and skills of the crew	x	x	
The ability to reach a compromise	x		
The ability to give commendation for properly conducted work	x		
The ability to reward – not only to punish	x		
The ability to deal with people	x		
The ability to resolve conflicts	x		
The ability to give orders		x	
The ability to shape positive relationships in the team		x	
The ability to enforce implementation of official orders		x	
MOTIVATION AND PERSONALITY TRAITS	1	2	3
Commitment to a task	x	x	x
High stress tolerance		x	x
Manners	x		
Responsibility, consistency		x	
Conscientiousness, self-discipline, firmness, fairness, Efficiency		x	
Readiness for suggestions of employees (experienced ones)			x
Flexibility			x

The list used the results of research conducted in the State Mining Authority in December 2013.

The information in Table 4 allows for the types of competence for which the deficiencies relate to each position in the supervisory department to be determined:

- professional knowledge of the maintenance manual of machinery and equipment,
- professional skills: the ability to carry out work in accordance with mining regulations,
- administration/management: the ability to make fast decisions, the ability to plan and organize work, the ability to properly assess the situation,

- interpersonal communication: the ability to provide comprehensive information concerning the entrusted tasks, the ability to transfer knowledge,
- interpersonal skills: the ability to cooperate (with superiors, subordinates, colleagues),
- motivation and personality traits: commitment.

It should be emphasized that according to Table 4 a number of issues related to interpersonal skills relate to higher level supervisors. This is significantly higher than recorded for other positions in this department.

The diversity of problems related to supervisors competence of the three mines.

Although the sample test size does not allow for the drawing of too far-reaching conclusions for individual mines, it is worth mentioning – but with great caution – that they differ in terms of the problems in the area of competence. Table 5 presents this issue and contains the following data:

1) the scale of the problem; the categories of competence for which the problem has been defined by supervisors – in accordance with the conducted study – as a key in the three mines (marked in red); this implies that the matrix of the importance of a given category of competence reached from 10 to 25 points (scale = assessment of competence – high percentage of the average ratings of at most x impact – high interest on the effect as significant),
2) red indicates competence categories assessed at the 4th and 5th level in three mines, therefore – according to the above mentioned actions – more than 60% of supervisors has concluded that they are average at best.

Table 5. Assessment of the competence of supervisors and the impact of each category on the safety level

Sub-categories of supervisors competence	Number of mines where the problem was rated as the key problem			Number of mines where categories of competence are on 4th or 5th level		
	HLS	MLS	LLS	HLS	MLS	LLS
A. Professional knowledge necessary for the proper execution of tasks	2	1	3			3
B. General knowledge of safety and safety management	2	1	2			2
C. Knowledge of regulations, procedures and instructions in the field of occupational safety	1	1	3			3
D. Knowledge and understanding of documentation and changes in documentation	1	1	2		1	2
E. The ability to transfer knowledge and instruction to subordinate workers – comprehensible formulation of thoughts and oral and written orders	2	1	3	1	1	2
F. Professional skills (technical and other related to the implementation)	1	2	2			2
G. Analytical and conceptual skills (decision making, problem solving, proper assessment of the situation – the ability to see the interrelationships between the various factors of the situation, so that the measures taken are effective and safe)	3	2	2	1		2
H. Organizational skills (efficiency, planning, division of labor, delegation, coordination)	2	1	1			1
I. Interpersonal skills (ability to work with people, understanding their motivation, etc.)	2		2	2		1
J. Readiness for changes – the ability to introduce new solutions	2			2		
K. Involvement in the implementation of tasks						
L. Responsibility, consistency						

Blank cells indicate that any of the three mines issue has not been evaluated as a key.

Relatively, the highest number of objections concerned the competence of lower level supervisors. Over 60% respondents rated two sub-categories of at most average, in three mines (level 4, 5), which, given the nature of the work and the present danger may be insufficient. This applies to professional knowledge necessary for the proper execution of tasks and knowledge, regulations, procedures and instructions in the field of safety. Such assessment concerned the following five sub-categories in two mines in lower level supervisors: general knowledge of safety and security management, knowledge and understanding of the documentation and changes in the documentation, the ability to transfer knowledge and instruction subordinate employees, professional skills (technical and other related execution of the tasks), analytical and conceptual skills.

Deficiencies in competence of higher level supervisors were revealed in the sub-category of interpersonal skills as well as one of the types of personality competence – readiness for changes. These categories were assessed at most as average by more than 60% respondents of the two mines. It is worth emphasizing that one coal mine was not assessed at the highest rating in the category of analytical and conceptual skills and the ability to transfer knowledge in higher level supervisors.

Shortages of skills and knowledge of transferring instructions, knowledge and understanding of the documentation and changes in documents are not of the strongest competences in the case of middle level supervisors. These two categories of competence were rated by more than 60% of respondents as average, at best, in one mine.

In relation to the issues discussed herein, it should be stated that the basis for determining the directions for the improvement of supervisors should be the assessment of the competence of each level of supervisors made in the subject enterprise, taking into account not only the identification of sub-categories of competence, but also their types.

4. CONCLUSION

Currently, the perfect employee according to an employer is not only highly qualified and certified, but an employee who has adequate competence within his professional role. Thus, competence is more than just knowledge and skills. Usually, it is also associated with motivation, social skills, personality traits and emotional intelligence. These additional features and abilities determine the full use of the potential of the qualifications.

Another issue which is also essential, in addition to the problems of mining efficiency and effectiveness, is obtaining and maintaining work safety. Chapter 2 demonstrates that the impact of competence is marked on three levels: general knowledge in connection with expertise influencing the reduction or even elimination of errors in management and decisions; professional knowledge reducing errors in decision-task situations; and skills conditioning the lack of errors in regulations. The full potential of an individual is, however, determined by their ability to cooperate, communicate efficiently, judge fairly and make decisions, their empathy, assertiveness and resistance to stress, etc. Thus, it can be assumed that the combination of high qualifications with desirable personality traits, social skills and motivation to use one's own abilities, results in professionalism, which entails the development of safe working conditions and safe operation.

Underground coal mines supervisors recognize the relationship between competence and safety, and that the size of the impact of individual sub-categories of competence on the safety level relates to the position held. The research results also enabled the determination of a set of core competences necessary at all levels: professional knowledge necessary for the proper execution of tasks, general knowledge of safety and security management and the ability to transfer knowledge and instruction to subordinate employees – the comprehensible formulation of thoughts and orders. Higher and middle level supervisors should – according to their own professional group – have: analytical and conceptual skills (decision making, problem solving, proper assessment of the situation – the ability to see the interrelationships between the different factors of the situation) and organizational skills (efficiency, planning, division of labour, delegation, coordination), as well as good knowledge of the rules, procedures and instructions in the field of safety.

The assessment formulated by the respondents relating to the individual sub-categories of supervisors competence in connection with a fixed level of impact on the safety level authorizes the presentation of the key issues in the area of competence of those who supervise the operations at each level. Problems of higher and middle level supervisors concern deficiencies in analytical and conceptual skills and the ability to transfer knowledge. Additionally, the problem with knowledge of the rules, procedures and instructions in the field of occupational safety was noted in middle level supervisors; and lack of openness to change, which influences the skill of creating new solutions was highlighted in higher level supervisors. The greatest range of shortcomings, however, relates to lower level supervisors, as it concerns six sub-categories of competence, including such important issues as technical professional knowledge, general knowledge in the field of occupational safety, professional skills, and the ability to transfer knowledge and instructions, and commitment to the task.

A number of significant problems were pointed out in addition to the key issues, among which two deserve attention, as they concern supervisors at each level: knowledge and understanding of documentation and changes in documentation, and interpersonal skills (the ability to work with people, understanding them, motivation).

The analysis of the key and important issues of competence allows us to draw the conclusion that deficiencies in knowledge relate to skills and competence that are essential and crucial for professional work and proper operation.

Collected empirical material also allowed for the listing of the types of competence in respect to the occurrence of gaps (knowledge, skills, and motivation and personality traits). The list includes nearly 70 items, while nine of them refer to each level supervisors: maintenance manual of machinery and equipment (knowledge), the ability to carry out the works in accordance with the regulations of mining (professional skills), skills – fast decision making, planning and work organization, proper assessment of the situation (management), the ability to provide comprehensive information concerning the entrusted tasks and the transfer of knowledge (interpersonal communication), the ability to cooperate with superiors, subordinates, colleagues (interpersonal skills), and further involvement as expressions of motivation.

Among the information included in the competence gaps, a number of issues related to interpersonal skills in higher level supervisors is particularly noteworthy – it is significantly higher than for other positions.

It is essential to add, that the competence of supervisors is a significant influencing factor on the level of safety in underground coal mines – according to the interested parties. At the same time, competence levels in many sub-categories is not satisfactory for supervisors, which allows cautious optimism about their supplementation or improvement.

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