MARIUSZ KAPUSTA [1]*, PATRYCJA BĄK [1], MARTA SUKIENNIK [1]

MODEL OF THE FORMATION OF WORK SAFETY CULTURE IN POLISH MINING ENTERPRISES

The article presents the results of research on the level of work safety culture, which is an important element influencing the organisational culture in mining enterprises. The article aims to measure the safety culture among managers in Polish hard coal mines. The assumed goal was achieved in the area of literature and empirical research. Research shows that the precise identification of hazards defined the thematic areas shaping safe working conditions in underground mines. The main part of the work was to survey 135 employees in 3 hard coal companies in Poland. The questionnaires were developed in cooperation with mining experts, and the 5-point Likert scale was used to evaluate individual questions. This methodological approach identified the subjective feelings and experiences of employees for building appropriate attitudes and behaviours that shape the organisational culture. The use of a culture grid enabled the creation of seven thematic groups of safety areas related to the so-called referents of organisational culture. The result of the empirical research is to propose an approach for the transformation of safety culture in the selected area for mining companies. The approach uses the organisational culture grid to shape the attitudes and behaviours of employees, which identifies and designates weak areas, defining them as unsatisfactory and unacceptable, and being the key conclusion of the research.

Keywords: organisational culture; mining enterprise; occupational health and safety; safety grid; hard coal mine

1. Introduction

The issue of organisational culture is of interest to many authors from around the world, and concerns many types of activities and many types of economic entities [1-4]. Contemporary scientists from many countries are trying to study the culture of work safety in underground mines that affects the culture of the organisation. A mature occupational safety culture should

1   AGH UNIVERSITY OF KRAKOW, AL. MICKIEWICZA 30, 30-059 KRAKOW, POLAND

*   Corresponding author: kapustam@agh.edu.pl
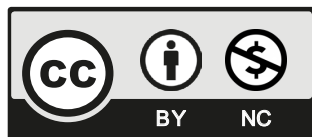
provide good results in reducing accidents [5,6]. An individual approach to the protection of employees while maintaining efficiency consists, inter alia, of improving work safety in coal mines [7]. For this purpose, each time a model of culture should be developed, addressed to the specific conditions of the company [8,9]. Organisational culture is one of the factors influencing the functioning and development of the company. In definitions, which appear in a large number in the literature, there are concepts and terms that are identified in organisational culture or define it. There are concepts of symbols, methods of communication, rituals, myths or the organisational climate [10-12].

So far, the Polish mining industry has not conducted cyclical studies to measure the culture of work safety. The diagnosis of the basic elements of the safety culture may significantly reduce the risky behaviour of employees [13]. In the last decade, mining companies focused on the implementation of occupational safety management systems while integrating them with the existing quality and environmental systems. Individual approach to the role of an employee in shaping the safety culture lowers the driving factor of recurring accidents [14]. A mature culture is considered an important safety measure for lowering worker morbidity rates [15]. Therefore, there is a constant need to use innovative methods of factor testing, which will limit mining accidents [16].

For this purpose, the authors used a safety culture grid to assess employee safety in Polish hard coal mines. At this stage, the research areas were selected, and the obtained results were analysed. The conclusions of the research allowed the proposition of 3 levels of occupational safety culture: satisfactory, neutral and unsatisfactory, which constitute a new solution to improving safety in Polish mines.

This article aims to present a model for assessing the safety culture of a mining company as a tool to assist decision-makers in areas of safety control. The realisation of the objective was carried out based on the collected material on:
- analysis of worker safety concerning accidents and occupational diseases in coal mines,
- an analysis of management actions and decisions taken during the SARS-CoV-2 coronavirus threat,
- definition of the concept of safety culture based on definitions in various industrial sectors,
- analysis of the psychosocial risks for workers in mining companies,
- assessing the effectiveness of knowledge transfer to workers by different training methods,
- assessing the impact and opportunities for managers to shape safe working conditions,
- carry out questionnaire surveys identifying areas of safety culture research,
- performing a SWOT analysis for the identified areas.

Comprehensive analysis of the materials made it possible to achieve the objective of developing an algorithm for assessing the safety culture of mining companies.

2. Review of the literature

Organisational culture is such a complex concept that it can be defined in various ways. There are also such approaches in the literature:
- "Organisational culture is based on unwritten, often subconsciously perceived rules that bridge the gap between what is unwritten and what is actually happening. It is about shared views, ideologies, values, beliefs, expectations and norms."[11]

- "Culture is a set of norms, values that employees adhere to, includes a hierarchy of values, remuneration, career development, loyalty and power, participation, mutual communication, and innovation." [17]
- "Organisational culture is a set of values, traditions, aspirations, beliefs and attitudes that are the essence of everything you do and think about in an organisation. It is fed by a system of rites, rituals, communication patterns, and informal structures." [18]
- "We can define culture as beliefs, convictions spreading in the company, regarding how to conduct business, how employees should behave and how they should be treated." [19]

The most common definition and interpretation of organisational culture follows Schein's model. It is defined as a model that organises the notion of culture. Schein used the iceberg metaphor to which he compared the elements he extracted. Schein identified the components of culture on three levels: assumptions, beliefs and values, and artefacts [20]. Artefacts are visible and perceptible structures and processes, observed behaviours (difficult to decipher), that is, everything that can be identified by our senses (sight, hearing, smell, touch). In order to properly categorise them, they have been divided into:
- linguistic (concerning the language used by group members, but also phrases used in specific situations),
- tangible (e.g. buildings, works of art, books, clothes, food, etc.),
- behavioural (e.g. behaviour, rites, rituals).

The presented beliefs and values reflect ideals, goals, values, aspirations, ideologies, and rationalisations (congruent or inconsistent with behaviour and artefacts).

Assumptions, on the other hand, are subconscious, taken for granted beliefs and values (determined behaviour, perception, thoughts and feelings).

This model is called the iceberg model because artefacts are the most visible, but what really shapes a society's behaviour and attitudes are assumptions that cannot be seen and understood without knowing a deeper layer of the cultural code.

Due to the complexity of the organisational culture and the multitude of its determinants and classification, both the study and measurement of its size and shape are ambiguous. In the literature on the subject, researchers propose solutions in this area, and similarly to the definition of organisational culture, there are many approaches here.

The solution proposed by Cameron and Quinn [21] assumes that there are three approaches:
1. A holistic approach, where you should immerse yourself in the culture of a given organisation and make an in-depth observation, becoming a member of this organisation, as it were.
2. A metaphorical approach based on the analysis of patterns in documents, papers, reports and conversations.
3. A quantitative approach that uses surveys, questionnaires, and interviews to assess specific aspects of culture.

Several research methods can be used to evaluate and study the cultural functioning of an organisation [22]. These include:
- training session, based on working with a team of dedicated people, members of the organisation to identify organisational problems and culture,

- the cultural profile allows us to diagnose the most crucial differences between the current state and the desired culture and present them in a visual form, however, it is based on a survey conducted among employees,
- understanding meanings, these are employee meetings during which individual features are interpreted, and the common meaning of selected elements of all employees is resolved,
- a reflection method that allows to confront the perceptions of individual employees or employee groups with their perceptions of other members of the organisation,
- analysis of field forces, consisting in the diagnosis of forces supporting and inhibiting changes in the organisation based on a questionnaire, the result is a recommendation in the field of strengthening supporting forces and limiting the forces inhibiting cultural changes,
- The engagement map consists of defining the roles of individuals and then determining their attitude to these changes.

Of course, the nature of the conducted research is also distinguished as there are both qualitative and quantitative tools. The quantitative methods include [23-25]:
- PAPI (Paper and Pen Personal Interview), i.e. a direct questionnaire interview,
- CATI (Computer Assisted Telephone Interview), i.e. telephone interview but using a computer,
- CAWI (Computer Assisted Web Interview), i.e. an online interview,
- IOCA (Instrument for Organisational Culture Assessment), proposed by Cameron and Quinn is a structured survey consisting of a series of questions about the organisation,
- OCI (Organisational Culture Index), a questionnaire developed by Cooke and Lafferty, consisting of 12 questions concerning the norms of behaviour prevailing in the organisation.

The qualitative methods include:
- interviews,
- on-site tour,
- observations,
- participating observations,
- analyses.

One of the tools that can be used to diagnose culture in a given enterprise is a map of organisational culture. Its construction assumes "five-element approaches to defining culture in an organisation" [22]. These five elements consist of the following areas in which culture is defined:
- customer focus,
- people focus,
- standards of operation and responsibility,
- openness to changes and innovations,
- process focus.

The proposed approach was developed by the creators based on both research and experience gained while working with companies, and the above aspects, according to the authors, are crucial for the financial results achieved by companies.

The map of organisational culture based on the above dimensions helps to determine the direction in which the culture of a given organisation is heading but also allows for the identi-

fication of potential discrepancies. The map is created based on five dimensions of culture, and each of them is defined in three aspects fundamental to organisational culture, namely: values, beliefs and norms.

Another tool that can be used for researching and assessing organisational culture in enterprises is the cultural survey. The survey, also proposed by Flamholtz and Randle, measures [26]:

1. cultural fit, defining consistency with the declared or desired values,
2. behavioural consistency, i.e. the degree to which employees' behaviour is consistent with the declared and desired culture,
3. cultural gaps, i.e. differences between the declared and desired values and the observed behaviour and behaviour.

The questionnaire is in the form of a questionnaire, which consists of a series of declarations, assessed according to the adopted gradation by the respondents. It is necessary to initially identify and define the currently functioning elements of culture in the organisation when conducting the research. The starting point can be a declaration of values by the company, and if there is none, define the desired values declared by members of the organisation.

The next step is to transform these elements of culture into statements and declarations that reflect elements of culture. Then, each assertion and declaration is assigned a grade. The authors of the tool proposed the Likert scale. The survey assumes assessment by the respondents in two perspectives: the existing culture and the desired culture. Based on the results obtained from the survey, it is possible to determine how distant two states of the organisation's culture are between the one currently present in the organisation and the one that is desired and expected by its employees. The results can help you to develop a plan to transform your company's culture.

An alternative way of creating a cultural map of an organisation is to analyse its cultural symptoms. This approach helps to identify the organisation's values, norms, and acceptable behaviours. Diagnostic techniques are available in the literature to aid in this analysis, such as: [27]

• making a tour of the company,
• documentation analysis,
• participation in management meetings,
• survey research.

To summarise, the organisational culture is not homogeneous, and the research and measurement methods are heterogeneous. Therefore, it seems that to carry out a thorough study, the methods and tools that best suit the nature of the organisation should be used. The possibility of carrying out these tests or using tools is also crucial. A common solution is to mix several different tools and define the culture of the organisation with quantitative and qualitative solutions.

3. Materials and methods

3.1. Questionnaires and surveys

In world literature, we can find many publications on the culture of work safety. Most often, authors adjust its features to the individual legal, economic, organisational and mining-geological conditions existing in individual countries. The common feature is the fact that it is closely related to the processes of management and risk assessment [28,29]. The research consists of developing

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questionnaires or surveys and conducting them among a representative sample of employees of mining plants [30]. The information thus obtained often enables underground mine management to develop a set of rules for effective compliance [31]. Safety culture can also be treated as an indicator of the level of implementation and understanding of safety standards and regulations in the enterprise. Methods of measurement are necessary in this regard. One of the most frequently used methods of measuring the culture of work safety is an expert interview, which allows one to determine the specific conditions of employees' behaviour in the organisation [32]. The research results obtained in this way make it possible to analyse the errors of employees in enterprises and determine the future directions of the research [33].

3.2. Safety culture grid

Another method of measuring the health and safety culture is the so-called safety culture grid (Fig. 1). The purpose of the grid is to indicate the strengths and weaknesses of the safety culture in the analysed enterprise. Its purpose is also to indicate what solutions should be applied by the company to strengthen the level of safety culture in its structures.
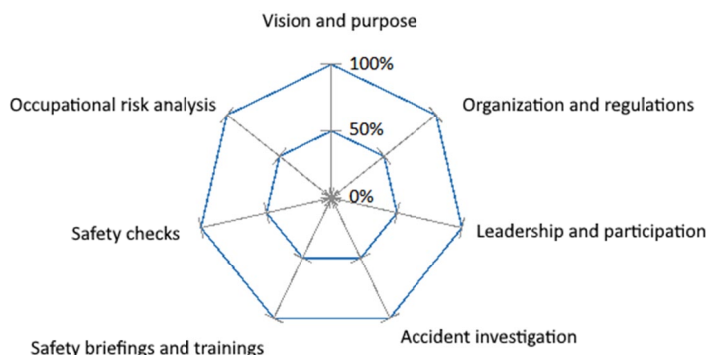

Fig. 1. Safety culture grid. *Source:* own study based on [34]

The grid is in the form of a heptagon, on the poles of which there are factors that determine the level of safety culture in the enterprise. Those are:
- Vision and purpose,
- Analysis of occupational risk,
- Safety checks,
- Safety briefings and training,
- Accident investigation,
- Leadership and participation,
- Organisation and regulations.

In the grid, the values are specified on a percentage scale. Individual factors are assigned a specific value, resulting from the characteristics of this feature in the assessed enterprise. This value is then marked with a point on the grid. After determining the value of points for all features, an area is generated that determines the level of security culture in a given organisation.

The curve created by combining individual points provides information about the percentage share of individual factors in shaping the level of safety culture in the enterprise.

3.3. Benchmarking

Another tool that can help determine the level of occupational health and safety culture is benchmarking. In benchmarking, the safety culture can be divided into three segments [35]:

- organisation of "ease" – in which security remains a topic and task for individuals, primarily specialists in this field,
- an organisation of "accountability" – in which there are good organisational structures, but the organisation still puts safety as a task for management. As a result, not all activities take place in accordance with the provisions.
- culture of responsibility – this is a situation where occupational safety and health are the total tasks of the management, but also the behaviour of employees is more and more self-responsible. In this model, accidents are seen as safety failures.

The above categorisation can be illustrated in a cascade fashion (Fig. 2).

Fig. 2. Segments of the safety culture. *Source:* own study based on [35]

The lowest level is occupied by the organisation of ease, characterised by a low level of implementation of the rules and the lack of interest of the employees themselves in caring for the health and safety culture.

The next level is the organisation of accountability, where the organisation prepares health and safety rules, can even create safety systems, and employees are aware of the consequences of non-compliance and follow the established rules (usually in the form of rigours). The highest level determines the culture of responsibility and proves that the organisation is organisationally prepared to comply with the principles of occupational health and safety, and the employees consciously and automatically care that these regulations are respected. Moreover, it initiates, implements and reactively monitors the idea of a safety culture in the everyday behaviour of employees for business and humanitarian reasons [36].

When analysing this classification, it seems evident that each entity pursues a culture of responsibility. This is especially important in the case of those entities where work safety issues are clearly outlined. This is the case in the mining industry, in particular in hard coal mines, where work safety is also determined by geological, mining and technical and organisational conditions. Self-identification of mines according to the above classification may contribute to the improvement of the level of safety, which will translate into an increase in the level of OHS culture.

Based on benchmarking, it is also possible to compare the results achieved by individual enterprises. In the case of the mining industry, taking into account their current capital structure, you can compare selected mines within one capital group, or you can create statements of results achieved by competitive capital groups in the Polish mining market.

3.4. Research in Polish mining companies

Attempts to define the concept of safety culture in mining enterprises are to a decisive extent the result of the values, attitudes and behaviours of managers and employees' immediate superiors. The role of managers seems to be crucial in that they have a significant impact on the creation of appropriate management procedures and tools, including those related to ensuring healthy and safe working conditions [34]. Research on this issue is grouped into three areas focusing on: tools supporting the safety culture, the role of the managerial staff and direct superiors in the process of shaping this culture, and the employees themselves [37]. In mining enterprises, a more pragmatic approach prevails, and the definition according to which safety culture is more often defined as a reaction to occupational risk, which manifests itself in the ability to draw conclusions from incidents and accidents whilst predicting and preventing dangerous situations [38]. Employee education is an effective tool as part of creating principles, and attitudes and building a culture of work safety. This process can be carried out by educating selected groups of employees on postgraduate studies or specialised courses and transferring the acquired knowledge to all employees. This form of improving and acquiring knowledge by employees also creates the possibility of obtaining the necessary professional qualifications to work in OSH services. The courses and postgraduate studies in occupational safety and health are often a priority for mining enterprises, which are profiled and ordered by employers from the mining industry [39].

4. Results

4.1. Research environment

In the period from November 2017 to February 2019, the authors conducted research on the level of safety culture in three hard coal companies using the auditorium survey technique. The survey was conducted among employees of the companies: JSW S.A., LW Bogdanka and PGG. The selection of companies was deliberate and included companies employing a total of approx. 90% of employees for the entire industry in Poland.

The survey was preceded by a diagnostic survey method, defined as an expert method carried out individually with employees of health and safety services and social labour inspectors in mining enterprises. As a result of these consultations and the experiences of the authors from previously conducted research, a group of 120 issues was created relating to the beliefs and views declared by experts in the field of work safety in mines.

Then, these issues were discussed by a whole group of experts, which resulted in the selection of 35 topics. After defining the assumptions for the sample survey, surveys were conducted among employees in managerial positions (mining supervision) selected for the sample at random. In most surveys, an estimate of the average value of a certain characteristic (age, seniority, gender, etc.) is considered. Depending on the size and type of population, independent random sampling, unconstrained dependent sampling or stratified random sampling are used. TABLE 1 shows the

areas surveyed and the statements that employee managers filled out in the surveys. The use of the expert method allowed the authors to distinguish seven thematic groups, which were clarified in the questionnaires with specific questions. In addition, the questionnaire itself was expanded to include information on the age and length of service of the respondents as well as knowledge of the knowledge of certificates and management systems operating in the mine. A five-point Likert scale was used to evaluate individual questions [40].

TABELE 1

Survey questions and statements for employee managers. *Source:* own study

No.	Questions and statements	Research area
1	Management makes employee safety a priority	Vision and purpose
2	Employees have a say in health and safety decisions made by management	
3	Management seeks new solutions to improve safety	
4	Employees can solve problems together with management	
5	I feel responsible for safety conditions	
6	I know the level of occupational risk	Analysis of occupational risk
7	I know the hazards at my workplace	
8	I tolerate unsafe behaviour of employees	
9	The atmosphere in my company is tense	
10	Reporting near misses	
11	Health and safety regulations hinder and slow down work	Safety checks
12	Penalties are effective for breaking regulations	
13	Supervisors' visit to workplaces creates uncertainty and tension	
14	Defects are repaired on a regular basis	
15	I enforce the use of personal and collective protective equipment	
16	Work safety training allows you to expand your knowledge	Safety briefings
17	I know who I can immediately turn to in case of an emergency	
18	Information is provided regularly in an understandable manner	
19	I check the level of knowledge of health and safety	
20	I organise safety training and talks	
21	I know who to report the accident to	Accident investigation
22	I know how to provide assistance to an injured person	
23	I know how to behave in case of an accident	
24	Post-accident recommendations are implemented immediately	
25	I inform about statistics of accidents and occupational diseases	
26	I improve my knowledge and professional qualifications	Leadership and participation
27	In difficult situations, I can count on the support of my superiors	
28	There are quarrels and misunderstandings between employees	
29	I take measures to popularise the topic of occupational safety	
30	Management appreciates safe employee behaviour	
31	There is a good communication system in the area of health and safety	Organisation and regulations
32	I tolerate deviations from the rules of safe work	
33	I allow workers without the required qualifications and authorizations	
34	I accept inadequate organisation at workplaces	
35	I operate under pressure from my superiors	

4.2. Research approach and results

The research was conducted among employees in managerial positions (mining supervision) selected for the sample at random. A 5-year distribution period by seniority was adopted, as the mining industry is characterised by stable employment and low turnover among supervisory employees. The differentiation of threats at workplaces in individual companies' plants may undoubtedly have an impact on the perception of safety issues. The questionnaires were completed by 135 employees in proportion to the total number of people employed in individual coal mining companies.

To determine the size of the sample, the number was determined according to the formula:

$$n_0 = \left[\frac{u_\alpha^2 \sigma^2}{\Delta^2} \right] + 1$$

where:

σ^2 – population variance,

u_α – quantile of distribution $N(0,1)$ for the confidence factor $(1 - \alpha)$, $P(|U| < u_\alpha) = 1 - \alpha$,

Δ – acceptable, predetermined, error in the estimation of the mean.

Taking into account the principles of sample selection, it was calculated that the minimum number of surveys should be 106, assuming a significance level of $\alpha = 0.1$. During the study, 135 surveys were completed, which meets these assumptions with the desired estimation accuracy of $\Delta = 5\%$.

Class selection for sample size was chosen from a TABLE 2.

TABELE 2

Selecting the number of classes according to the number of samples

Number of measurements n	Number of classes k
30-60	6-8
60-100	7-10
100-200	9-12
200-500	11-17
500-1500	16-25

Since the period of service for underground miners can be 25 years, it is reasonable to divide it into 6 classes for a sample of 135. The tabulation (TABLE 3) presents the respondents' seniority, which is visualised in Fig. 3.

In light of the research obtained, it is worth noting that among employees, seniority in the range of $16 \div 20$ years prevails, which constitutes 25.2% of the respondents. On the other hand, the data proving that only 8.9% of the respondents are employees with work experience of up to 5 years, which in the future will result in a "generation gap," is disturbing.

Based on the obtained data (TABLE 4), radar charts were created, which are to present the level of safety culture in the analysed areas of assessment. Fig. 4 shows the Safety Culture Grid of the surveyed mining enterprises, which visually represents the obtained results.

Summary of data on the number of years of service of the respondents ($n = 135$). *Source:* own study

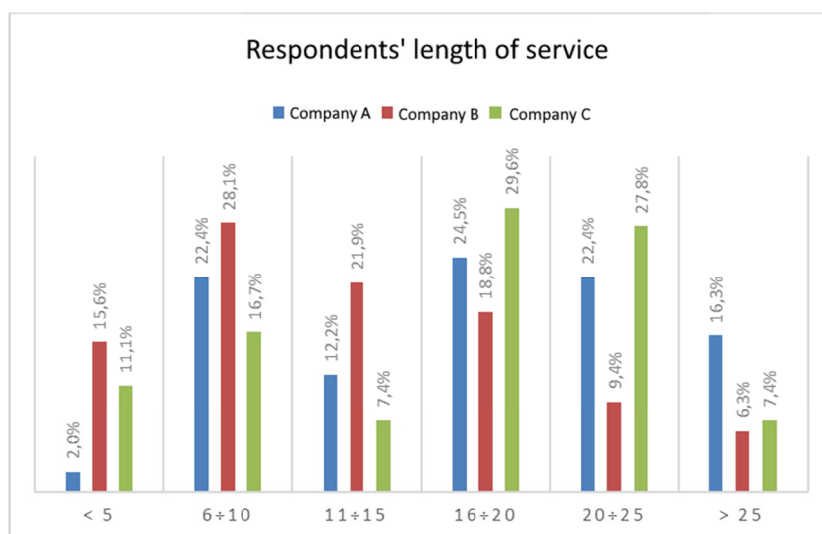| Work experience in the plant								
Years	Company A		Company B		Company C		Total	
	No. [49]	%	No. [32]	%	No. [54]	%	No. [135]	%
<5	1	2	5	15.6	6	11.1	12	8.9
6÷10	11	22.4	9	28.1	9	16.7	29	21.5
11÷15	6	12.2	7	21.9	4	7.4	19	12.6
16÷20	12	24.5	6	18.8	16	29.6	34	25.2
21÷25	11	22.4	3	9.4	15	27.8	29	21.5
>25	8	16.3	2	6.3	4	7.4	14	10.4

Fig. 3. Distribution of the length of service of respondents in the surveyed mining companies.
Source: own study

Results from the areas of work safety culture research. *Source:* own study

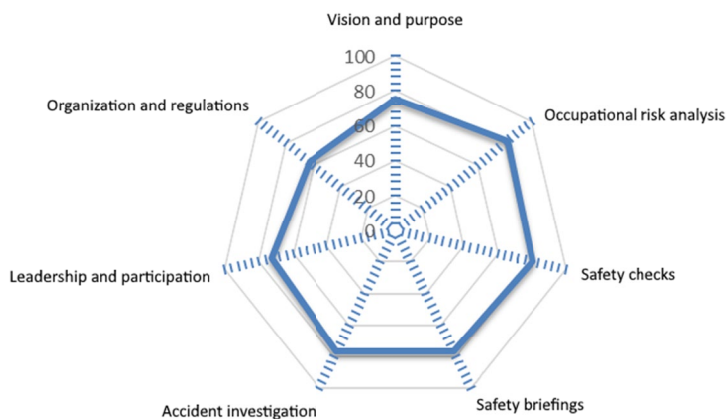| Research area	Company A	Company B	Company C	Total
	[%]	[%]	[%]	[%]
Vision and purpose	80.4	67.5	76.7	75.3
Analysis of occupational risk	81.3	80.1	83.6	82.0
Safety checks	84.5	81.9	75.9	80.4
Safety briefings	83.7	75.0	72.2	77.0
Accident investigation	83.3	76.2	71.5	76.9
Leadership and participation	80.0	73.1	62.5	72.4
Organisation and regulations	64.5	63.1	62.2	63.2

Fig. 4. Safety culture grid for the studied mining industry. *Source:* own study

The next chart (Fig. 5) shows the safety culture grid broken down by individual mining companies. In line with the authors' assumption, the simultaneous diagnostic and analytical approach makes it possible to identify strong and weak areas of the safety culture [34]. Thus, an attempt can be made to interpret the identified unfavourable phenomena and make inferences aimed at the detection of dysfunctional areas. The conclusions obtained from the research should serve as indications for the improvement of work safety.
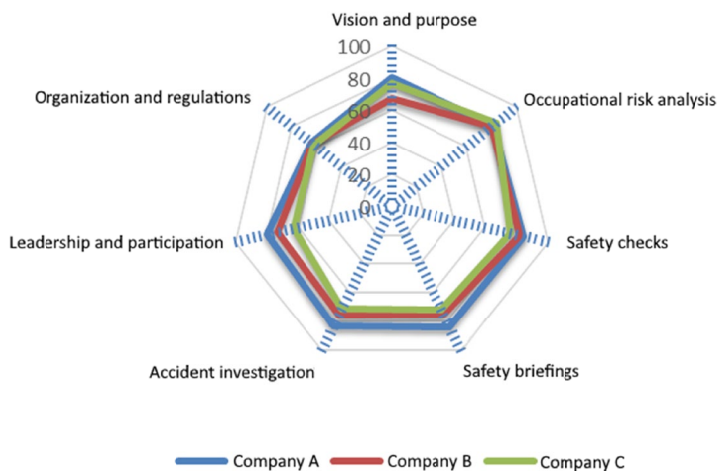
Fig. 5. Safety culture grid in individual mining companies. *Source:* own study

4.3. Data analysis and interpretation

Each of the seven areas of the study contained five survey questions (TABLE 1). Employees subjectively provided answers on a scale of 1-5. The highest values were assigned to very

high standards of occupational safety attitudes and behaviour and the lowest to violations and negligence. The analysis of the research results shows that the greatest deficit occurs in two areas, which are:
- attitude to work organisation and legal regulations,
- the attitude of management and participation in terms of safety.

In detailed studies, a five-point Likert scale was used, which allows to define the safety culture on three levels. Graphical visualisation with the help of radar charts significantly facilitates the interpretation of the results.

As shown in Fig. 6, the model for classifying occupational safety culture areas classifies the subject into one of three levels. For further analyses, it was assumed that the satisfactory results would be those that are above 75% in the registers. The results ranging from 65% to 75% were considered mostly satisfactory, while those below 65% as unsatisfactory. Thus, for the areas in the unsatisfactory scope, it was assumed that in such a case an urgent intervention should take place in the enterprise.

The consequence of the adopted division criteria is proposals for taking action in particular areas. Satisfactory as well as neutral results are the appropriate level of work safety culture. In the event of an unsatisfactory level in the enterprise, immediate corrective actions should be taken.
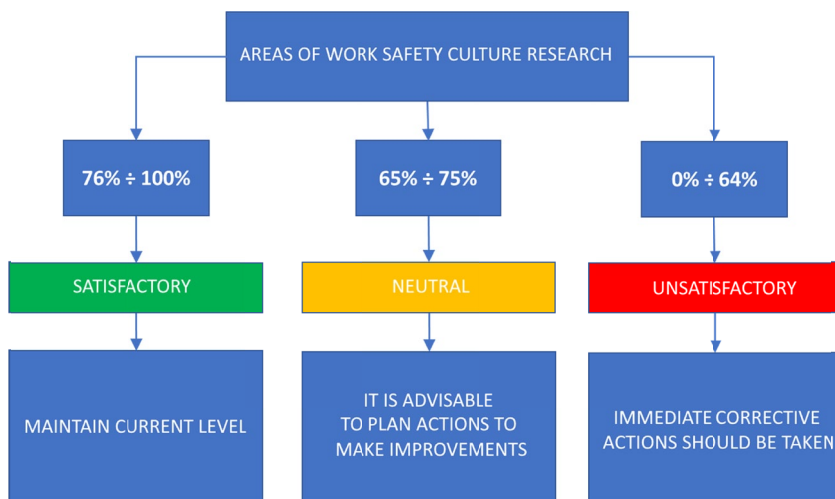

Fig. 6. Model for classifying the level of work safety culture for individual areas.
Source: Own study

For the criteria adopted in this way to determine the level of safety culture in the analysed mining enterprises, four areas met the satisfactory conditions, two were designated as neutral, and one area was unsatisfactory. The area of "organisation and regulations" was identified as the weakest and described as unsatisfactory by the employees of all three mining companies. On the other hand, the areas of "occupational risk analysis" and "security checks" achieved a satisfactory level in all three companies. The results of measurements of safety culture areas are presented in TABLE 5.

Results of satisfaction levels in the areas of work safety culture research. *Source:* own study

Research area	Company A [No.]	Company B [No.]	Company C [No.]	Total [No.]
Satisfactory	6	3	5	4
Neutral	0	3	1	2
Unsatisfactory	1	1	1	1

The survey conducted in underground mines allowed the authors to present an algorithm for measuring safety culture at work. The block diagram of the survey implementation consists of four independent stages and is presented in Fig. 7. The entire survey is carried out by an external auditor for stages II and IV the involvement of the company's management is necessary.
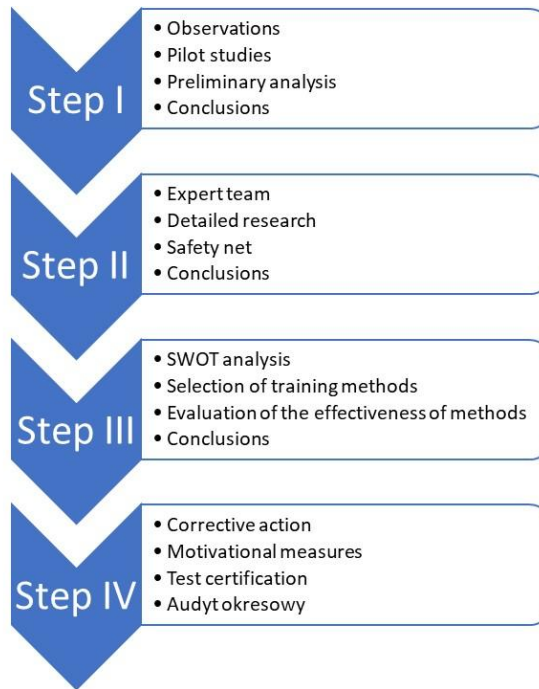

Fig. 7. Algorithm for measuring workplace safety culture. *Source:* [34]

The first stage is an activity that involves familiarising the external auditor with the company's 'safety climate'. Observation, pilot studies and preliminary analysis are the process of obtaining information in order to identify legal and formal inconsistencies. The second stage involves the involvement of management to draw on expert knowledge and experience. Detailed surveys are conducted to create a safety culture grid and identify deficits in employee attitudes and behaviour. The third stage involves a SWOT analysis, the results of which will allow the proper selection of training methods. Once training is completed, the effectiveness of the training

methods used is evaluated and verified. Stage four consists of corrective actions and employee motivation programmes, which require strong commitment and support from company managers. An integral part of completing the algorithm for implementing a workplace safety culture is the certification process and periodic audit [34].

The article is the first stage of the presentation and analysis of the transformation of mining enterprises in the area of organisational culture. The authors conduct ongoing research in this aspect. The research in question is extremely time-consuming and requires precision. Following the research, it is planned to develop further articles presenting various aspects of the organisational culture in the Polish mining sector in light of dynamic changes. The approach mentioned in the article will be the subject of the next publication, in which it will be discussed in detail.

4. Discussion and conclusions

The results of the research presented in the paper confirmed the differentiation in the level of safety culture in hard coal mines in Poland. However, a positive sign is the fact that in the case of the analysed companies, unsatisfactory areas were in a significant minority.

The proposed approach is used to identify the level at which the examined area of security culture is located. Classification to the red zone (unsatisfactory level) should be a clear signal for managers that corrective or corrective actions should be taken.

The approach was presented in cooperation with the safety culture grid, but it can cooperate with other methods and based on the results of other studies, allowing to determine the level of work safety in particular areas. In the opinion of the authors, this form of classification is universal. Going through the steps indicated in the approach, regardless of the methodology of researching the level of health and safety culture, gives a clear indication to decision-makers what to take further actions.

Mining, however, is a branch of industry in which it is impossible to reduce some risk areas. One such area is that of occupational health and safety. It is therefore necessary to constantly look for innovative solutions that will make people's work safer and more comfortable. Based on the conducted research, it can be concluded that there are still opportunities to improve health and safety conditions in mining enterprises. To achieve a high level of work safety culture, actions and efforts are necessary both on the part of the company's management and at the same time with the full commitment and participation of manual workers.

The proposed work safety culture approach can be a practical tool to be used by mining companies. For the criteria adopted in this way to determine the safety culture approach, in the analysed mining enterprises (results of the research), four areas met the conditions of satisfaction, two were designated as neutral, and one area was unsatisfactory.

The author's contribution is the proposal to build this approach to the work safety culture, taking into account the conducted empirical research. This is the result of practical experience, a detailed analysis of the literature and the specificity of threats resulting from working underground. Based on the experience of the authors and the research described in the above article, the following conclusions can be drawn:

- in mining enterprises, it is possible to build a work safety culture based on the observation of hazards occurring at workplaces in order to identify hazards with hazardous, harmful or nuisance factors;

- the implementation of any preventive solutions should be preceded by pilot studies among employees. The result of this work is the creation of a preliminary list of threats, irregularities and inappropriate behaviours;
- preliminary identification of threats allows for the confrontation of irregularities with decision-makers in the company. The appointment of an expert team ensures a substantive approach to the issues as well as guarantees the importance of the activities carried out. In addition, it is also important to formulate detailed survey questions as well as plan the organisation of research and its systemic conduct;
- individual test questions combined into a group from the areas of occupational safety research. This requires the use of a five-point Likert scale, and the presentation of results are presented on a radar chart creating a safety culture grid;
- in the case of unsatisfactory levels of safety culture, this may force additional financial costs. It is worth emphasising, however, that some improvement effects can be achieved through better organisation of work, improvement and learning from own mistakes.

The approach to the work safety culture proposed in the work is to emphasise the multi-threaded and interdisciplinary nature of issues related to the danger of human work underground. The proposal of this approach along with the change of solutions constitute the basis for determining the rules for testing the level of safety culture in the enterprise, the next stage of which should be the development of a system of employee motivation and certification procedures by external entities (which is the subject of current research by the authors and will be the aim of subsequent publications).

Funding

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