Research of Safety Culture Determinants in Slovakia Engineering Companies

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Keywords: safety culture, evaluation of enterprises, questionnaire method

ABSTRACT

The paper deals with safety culture evaluation in Slovak companies. Taking into account the conditions of enterprises in the Slovak Republic, specific research methodology has been developed for the research of the safety culture status in engineering companies. The questionnaire survey method was used. With regard to the scope of research, 10 determinants was defined, which form the basis for the assessment of safety culture elements. In assessing the level of each of the 10 safety culture determinants, the relationship between enterprise size (small, medium, large) and the points assigned to each determinant was defined. The research result is comprehensively evaluated using a point graph. The discussion shows parts that were evaluated the highest or lowest and outlines suggested approaches to improve the current state.

INTRODUCTION

Safety culture is understood as an integral part of corporate culture and it is reflected in implementation and workings of the OH&S management system. It is important to understand that implementation of an OH&S management system at an enterprise is a tool that can increase work effectiveness, work organization and can optimize work processes. Ability to sustain a functioning system is a factor contributing to a company’s. Despite a rule that states that implementation of an OH&S management system needs to be voluntary, based on some legislative specifications that are in place, this rule imposes implementation of some measures, which are simultaneously elements of an OH&S management system. Sadlowska—Wrzesińska [1] explains that safety culture determines also quality of life of citizen, making the occupational safety culture one of the basic conditions of national security in the long term.

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HSE characterizes safety culture in an organization as a result of group understanding of competencies, model behaviour of responsibilities, style and professional adaptability of management of an organization. Organizations with a positive safety culture communicate based on mutual trust and share perceived importance of safety and trust in effectiveness of prevention [2], [3].

IAEA states that safety culture is a diagram of characteristics and approaches in an organization and individuals that determine that the main priority are questions of safety in the organization, and as such they receive attention that ensures their importance [4].

Organizations with high safety culture and with developed understanding of safety at work have the following characteristics:

- Symmetry between official statements and daily work.
- Direct and open approach to weak areas, approaches that focus on finding a solution.
- Move away from culture of finger pointing.
- Employees and management act responsibly, independently, with a team focus. Safety culture is part of their daily life.
- Safety standards are accepted and integrated into daily activities.
- Safety and health safety are highly regarded by employees and by the organization as a whole.
- All levels of management and employees are actively involved in safety.

Nowadays, research related to safety culture is performed to gain understanding of its scope and components and the relationship between safety culture and operational safety. There are many approaches how safety culture can be measured. These differ in terms of statistical criteria, detail of analysis, economic advantages or their use. Safety is studied in relation to several factors, however mainly for various industries, different approaches by management and various problems [5], [6]. The highest level of culture is implicit common understanding among people within a team and the entire organization. Approaches and believes can change behaviours, which can lead to potential problems.

The paper discusses evaluation of safety culture in specific industrial organizations in Slovakia. We used the survey-based research method in which respondents evaluated level of ten determinants of safety culture, by answering a group of thirty questions. Results of the research showed in which areas organizations have a strong or a stable position and were improvement is required. This article is part of a grant project KEGA, no. 011TU Z-4/2017 “Integration of progressive information technology and soft-skills in study programs focusing on management of production processes”.

SPECIFICATIONS OF DETERMINANTS AND RESEARCH METHOD

The goal of the research was to evaluate levels of safety culture in Slovak enterprises. We selected the survey-based research method, which is used for given character of research goals. The basis of the research was not to evaluate compliance with legislation, which is mandatory for all employees [9]. The goal was to determine, with the help of evaluation of specific areas, determinants, and the use of well-defined questions, whether outlined areas are implemented in companies’ processes on an
informal basis, that is whether they are an integral part of safety culture in researched enterprises.

Based on study of available literature [7, 8], expert views and acceptance of specific conditions in the analysed country, to evaluate the level of safety culture in Slovak enterprises, we have selected ten determinants that form the basis of evaluation of elements of safety culture. Determinants of safety culture are based on current legislation in Slovakia, specifically Act no. 124/2006 Coll. about safety and protection of health at work in later regulations. To evaluate levels, we specified the following determinants of safety culture, which are relevant for evaluation:

1. Company’s policies.
2. Safety processes.
3. Motivation for OHS.
4. Education about OHS.
5. Communication.
6. Employee involvement.
7. Management’s involvement.
8. Management’s responsibility.
9. Ensuring safety.
10. Contribution to safety.

For the survey, we used above-mentioned ten determinants which consisted of thirty questions—each determinant had three questions. The goal of the questions was to evaluate whether level in a specific area is sufficient, how respondents perceive completion of tasks and responsibilities and whether they actively contribute to safety at their place of work.

To evaluate answers to individual questions, we used Likert’s evaluation scale, represented by point evaluation, as seen in Tab. 1. Each respondent selected in each question one phrase, however during evaluation the corresponding number was used for calculation.

| Phrase       | Highly disagree | Disagree | Cannot evaluate | Agree | Completely agree |
|--------------|-----------------|----------|-----------------|-------|------------------|
| Point evaluation | 1    | 2        | 3               | 4     | 5                |

The structure of the survey was created based on identification of determinants and their specification with the help of questions and Likert’s evaluation scale, which was transferred into electronic form. For online publication of the survey, we used a web application www.iankety.sk. Here we programmed individual questions to evaluate the level of safety culture.

**Analysis of respondents**

After creation of the survey, it was disseminated to the appropriate parties. We emailed the selected respondents a request to participate in research regarding the level of safety culture, which included a specific online code of the survey and respondents could with the code directly connect to the survey online and complete it. We emailed the survey to 256 potential respondents, to companies operating in Slovakia. We received responses from 74 respondents. The rate of return of the survey was 28.9%,

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which is quite low. This low rate of return means that enterprises are not willing to evaluate their level of safety, potentially due to concerns about unfavourable results. Once the survey was completed, respondents were grouped based on industry of their organization, size, number of employees, region based on municipalities and based on respondent’s position in the organization.

The enterprises were divided based on size, specifically number of employees:
- Large—more than 250 employees (indicated as L )
- Medium—50-249 employees (indicated as M )
- Small—up to 49 employees (indicated as S )

Analysis of respondents in terms of company size (Figure 1) showed that the largest representation had small enterprises, 35%. We can state that all companies had similar representation, between 31-35%.

![Figure 1. Analysis of respondents based on company size.](image)

**RESULTS AND EVALUATION OF THE RESEARCH**

The results of the research were evaluated in software called STATISTICE (version 10). For visual representation of relationship between individual values we chose to show these on point graphs. We assumed that points assigned by individual respondents to individual determinants are clearly represented by arithmetic averages of assigned points and their visual representation is clear. The graphs allow for easy comparison of individual evaluated categories. For comparison of relationships between complex evaluations of levels of all ten determinants of safety culture and a company size is shown in 3D point graph—Figure 2. To show the level of a specific determinant of safety culture we used 2D point graphs categorized based on size—Figure 3.

When evaluating levels of the ten determinants of safety culture, which was based on the enterprise’s characteristics, we looked for relationships between the company’s industry (manufacturing, mechanical engineering or non-manufacturing), size of the company (small, medium, large) and points assigned to individual determinants. We assumed that in manufacturing enterprises work processes are more complicated, in terms of ensuring safety at work, which should be reflected in the level of their safety culture. We also assumed that enterprises with smaller number of employees should have their OHS management processes better set up, which should be reflected on a higher level of their safety culture.
Interpretation of determinants of safety culture for manufacturing engineering enterprises based on company size

Interpretation of results of determinants of safety culture in terms of company size for the group of manufacturing engineering enterprises by using point graph (Fig. 2) shows a complex representation of a given relationship. It is clear that the scope of values of individual determinants of safety is considerable, point values are between 3.4–4.55. As part of a more complex evaluation of level of safety culture in mechanical enterprises, we divided a sample of respondents into groups based on company size because we expected differences in terms of approaches towards OHS. The following can be also noted from results from graphs in Fig. 3:

When evaluating levels of safety culture based on company size, we note the following:

- Determinant 1–safety policy is evaluated as high (4.3–4.5) irrespective of the size of the enterprise. We presume that this is due to the fact that safety policies are prescribed by legislation and enterprises care to comply with given requirements.
- Evaluation of determinants 9 (ensuring safety) and 10 (participating in safety) in enterprises of all sizes is high (4.3–4.5), which is probably due to the fact that respondents evaluated their own behaviour and they evaluated it very positively.
- Determinant 3–motivation for OHS reached between 3.8–4.1 points in companies of all sizes, which means lower level. Also, lower level was in determinant 6, employee involvement (3.7–4.0).
• An interesting situation occurred with determinant 4 (education), where evaluation showed better results in category of M (medium) and S (small) enterprises, specifically 4.1–4.3. On the contrary, evaluation of these determinants in L (large) enterprises reached only level 3.9, which we consider to be the lowest value.

• Determinants 7 (engagement of management) and 8 (management’s responsibility) were evaluated higher in small and medium size enterprises than in large enterprises, that is 4.0–4.3. Determinant 8, management’s responsibility scored especially low in large enterprises, at 3.4, which is the lowest point of evaluation in manufacturing mechanical engineering enterprises. We can deduct from this, that in large enterprises employees do not perceive management’s involvement and their responsibility in terms of OHS positively and this is management’s big weakness.

Figure 3. Results of determinants evaluation of safety culture categorized by individual determinants.

DISCUSSION

Based on results of the evaluation, we can state that our assumptions were confirmed, specifically that in manufacturing enterprises work processes are more complex in terms of safety compliance, which was also noticeable in higher evaluation of safety culture. It also confirmed our assumption that companies with higher number of employees have better set up OHS management processes, which was reflected in higher level of safety culture. When evaluating individual determinants, we found that Slovak enterprises are successful in terms of safety policies and ensuring compliance with applicable legislation, no improvements are required. When considering positive evaluation of determinants, it proved our assumptions that evaluation of safety
compliance and participation in safety, where respondents evaluated their own actions, was rated highly.

We also compared selected enterprises based on radar graphs, a common tool used in evaluation of level of safety culture for one or several subjects. For this analysis, we selected an enterprise with the highest number of points in individual determinants (marked as max) and an enterprise with the lowest number of points in individual determinants (marked as min.). We compared the best and worst scorer. The radar graph shows a relative level of points in relation to the middle. The number of data points (categories) determines the axis of values (in our research these are 10 determinants of safety culture) and a value of a point and its distance from the centre of the graph. Each category has its own axis originating from the centre of the graph. Figure 4 shows a line graph to compare levels of safety culture in the best (MME max) and the worst (MME min.) manufacturing mechanical engineering enterprise of evaluated ten determinants of safety culture.

Based on the results from Fig. 4, we can see the large difference between the best and the worst enterprise in terms of safety culture and in some determinants the differences are as high as 2 points (e.g. no. 1 safety policies, no. 3 motivation towards OHS). We once again see that motivation in both enterprises is lagging behind other determinants.

![Radar graph to evaluate level of safety culture for the best and the worst manufacturing mechanical enterprises.](image)

The best enterprise in the MME category is in large enterprises (has 268 employees) and produces aluminium profiles for the automotive industry. We can see from the results that aside from determinant no. 3, motivation, (4.3. points), all other evaluated areas are evaluated highly, surpassing 4.5 points and in determinants no. 1, 9, 10 reach maximum points, five. On the contrary, the lowest score received a small size manufacturing mechanical engineering enterprise that had 8 employees. In this enterprise, only determinant no. 7, management’s interest, was higher than 4.0, specifically 4.2. Other areas were evaluated below the 4.0 point.
CONCLUSIONS

It is important to state that creation and building of a safety culture fundamentally influences improvement in safety and health protection, it simplifies many complicated processes in this area and provides targeted motivation for employees to complete tasks related to OHS. Based on the conducted research, we can conclude that level of safety culture in Slovak enterprises does not meet the required level and there are many gaps when fulfilling individual determinants. Our findings confirm that evaluations of determinants that are anchored in Slovak legislation, specifically safety policies, processes and education in OHS, have the most positive results. However, areas such as employee motivation, management’s responsibility and interest did not receive positive results.

Based on result of our research we confirm that by improving management’s approach to building a safety culture, an organization will see improvement in employee motivation. In this case willingness to change will have a positive and important influence. Managers need to realize that only satisfied and positively motivated employees, who feel safe and unharmed, can produce at maximum and responsively complete work tasks. It states in OHS that employees are the most important asset of each organization. Managers’ roles, in terms of OHS, are to support, motivate and make employees’ activities more attractive, which leads to positive results, improvement of understanding of safety, lower accident rate, illness and attrition.

ACKNOWLEDGMENT

The authors would like to thank Agency KEQA for their support of the KEQA 011TU Z-4/2017 project “Integration of progressive information technologies and soft-skills in education programs focusing on management of production processes”. This article was created as part of the project.

REFERENCES

1. Sadlowska–Wrzesińska, J. 2018. Occupational Safety Culture. Development in the Conditions a Civilizational Solstice, Oficyna Wydawnicza ASPRA_JR.
2. Fedorycheva, I. and Hammer, M. 2015. A Description of Methods and Techniques of Safety Culture Research, MM Science Journal, 4. Available at: http://www.mmscience.eu/content/file/MM_Science.
3. HSE. 1993. Human Factors Study Group: Third Report—Organising for Safety. HSE Books. Available at: http://www.hse.gov.uk/humanfactors/topics/common4.pdf.
4. IAEA. 2009. Safety Standards Management System for Nuclear Installations. Available at: http://www.pub.iaea.org/MTCD/publications/PDF/Pub1392_web.pdf.
5. Hnilica, R. et al. 2017. Use of the Analytic Hierarchy Process for Complex Assessment of the Work Environment, Quality & Quantity, 51(1).
6. Simanová, Ľ., and Gejdoš, P. 2016. The Process of Monitoring the Quality Costs and Their Impact on Improving the Economic Performance of the Organization, Enterprise Management, 3:172-179.
7. Slováčková, I. 2015. Why and How to Measure Safety Culture in an Enterprise? In Bezpečnosť Práce v Praxi, 4. Available at: http://www.kirschstein.org/download/BezpecnostPraceVPraxi.
8. Tureková, I. and Turňová, Z. 2013. Assessment of Human Factor in Production Engineering, Proceedings of the 9th International Symposium on Occupational Safety and Hygiene, SHO 2013, Guimaraes, Portugal: CRC Press, 2013. pp. 567-571.

9. Matej, J. et al. 2018. Development of the Support Frame of a Universal Auxiliary Device for Extinguishing Forest Fires, Uzytkowanie Maszyn Rolniczych i Leśnych: Badania Naukowe i Dydaktyka. Poznan: Przemyslowy Instytut Maszyn Rolniczych, pp. 88–91.