International Journal of Industrial Ergonomics 44 (2014) 510–519

Contents lists available at ScienceDirect

International Journal of Industrial Ergonomics

journal homepage: www.elsevier.com/locate/ergon

Multicriteria analysis of safety climate measurements at workplaces in production industries in Serbia

Nenad Milijić*, Ivan Mihajlović, Djordje Nikolić, Živan Živković

University of Belgrade, Technical Faculty in Bor, Management Department, Vojske Jugoslavije 12, 19210 Bor, Serbia

ARTICLE INFO

Article history:
Received 21 February 2013
Received in revised form
25 February 2014
Accepted 10 March 2014
Available online 11 June 2014

Keywords:
Safety climate measurements
Reliability measurement
MCDA
Statistical analysis
Work places

ABSTRACT

This paper presents the results of measuring certain safety climate indicators in Serbian production companies. As a result of these investigations, which have already been conducted by this group of authors, a 21-item questionnaire was developed in 2010. In this research, we developed a methodological framework to measure the safety climate in Serbian companies. The investigation was carried out in companies that were engaged in different industrial sectors. The aim was to determine the initial degree of developing the safety climate in every industrial sector, i.e. to compare and rank them. The following demographic factors were used for this purpose: types of industry, the number of employees in the company, the position in the organizational structure of the firm, age groups, employees with a different length of work experience, employees' gender, those who have or have not been involved in an occupational accident and the level of employees' education. Our analysis defined the significance of every demographic subgroup based on the results obtained by measuring the safety climate in all organizations. However, taking into consideration a large number of subgroups, the starting hypotheses were proposed only for the two most important ones: the type of organization does have an influence on safety climate indicators – hypothesis H_1 and the position of the employee in the firm does have important influence on safety climate indicators – hypothesis H_2. Both hypotheses were confirmed on the base of the results of further analyses.

Relevance to industry: The questionnaire used in this paper provides the evaluation of safety climate in production companies, and the applied multicriteria methodology provides the comparative analysis of safety climate among the companies and different industries. It is suitable for research purposes as well as for practical use.

1. Introduction to the safety climate paradigm

In papers published recently, there have been numerous discussions concerning the importance of safety issues on the overall work performance of the companies (Silva et al., 2004; Lin et al., 2008; Snyder et al., 2008; Shannon and Norman, 2009; Kines et al., 2011; Radosavljević and Radosavljević, 2011). Most of these papers were dealing with the relationship (and differences) between safety climate and safety culture (Shannon and Norman, 2009). According to the mentioned investigations, safety culture is part of the organizational culture and it tends to focus on the deeper and less accessible core values and assumptions of the organization regarding safety and human resources. On the other hand, the review of the literature, conducted by Wiegmann et al. (2001) indicated that the term was first highlighted by Zohar (1980), so that the literature has never presented a generally accepted definition of safety climate. In fact, some definitions of safety climate are almost identical to the definitions of safety culture, while some are completely different.

One of the definitions of safety climate which is likely to be the most adequate for the investigations presented in this paper, is: "Safety climate is viewed as an individual attribute, which consists of two factors: management's commitment to safety and workers' involvement in safety" (Dedobbeleer and Beland, 1991). On the other hand, safety culture refers to the term used to describe a way in which safety is managed at the workplace, and often reflects "the attitudes, beliefs, perceptions and values that employees share in relation to safety" (Cox and Cox, 1991). Also, safety climate in the latest research is clearly correlated to safety behavior of the employees. Safety behavior can be understood as a result of the sociocognitive mediation process described by the theory of a planned behavior (Fugas et al., 2012).

* Corresponding author. Tel.: +381(64) 151 69 82; fax: +381(30) 421 078.
E-mail address: nmilijic@tf.bor.ac.rs (N. Milijić).

http://dx.doi.org/10.1016/j.ergon.2014.03.004
0169-8141/

Diversification of the safety issues in smaller fragments is usually applicable in well-developed western societies, where these items are well known and investigated in details in the last decades. Also, it is typical for large economies with well-developed industrial sectors. On the other hand, safety issues are important for the efficiency of the work process in any society. This way, the contemporary work environment requires the development of safety climate issues even in small economies. The fact is that Serbia is a small country in the southeast part of Europe. Until the beginning of this century, Serbia was under the socialist regime, in which safety climate was not considered as an important part of the working process. This created obstacles in safety culture development as a consequence in the environment based on workers management in all Serbian companies. The process of transition in Serbian economy started at the beginning of the new century, and at the same time this was also the beginning of a real consideration of safety issues in domestic industrial companies. Due to the transition, foreign investors started the privatization of Serbian companies and, together with new technologies, they brought new procedures considering the workplace behavior, including safety issues (Bogićević-Milikić et al., 2012). This led to the process of changing of all Serbian companies, including these that remained in public or state property, including the change of legislative issues in relation to workplace safety, as well. This indicates that the development of safety climate issues in Serbian companies has started; however, it is still in the early stage of development.

The lack of literature on safety climate in Serbian industries, is evident. The only way to start any investigations in this field is to adopt the methodology developed according to the previous international research, but with the intention to adjust it to the Serbian context. The process of adaptation would mostly depend on the influence of different demographic values on the safety climate measurement, since the demographics of Serbian workers should be to some extent different compared to the demographic of workers from other countries. Taking the above into consideration, we have decided to use the methodology that was originally developed according to the Western research, and subsequently adapted to the Chinese context (Lin et al., 2008). The reason for such a choice lies in the fact that China is also a country in transition toward coexisting capitalistic and socialistic systems. There exist both public and private companies. In this kind of situation, the specific working culture as well as the safety climate starts to appear. Serbia goes through the similar transition, where the private capital is present together with publicly owned companies, which have remained since the socialist regime. The Serbian work climate and the safety climate are still far behind the Western society. The necessity for the research presented in this paper can be further supported by the facts that there is no official register presenting the record of work accidents. Also, the accident analyses in Serbian companies have not been conducted on the organized level up to now. The potential occupational hazards for each workplace, included in the investigations presented in this paper, have been defined by the management of each company and the official person responsible for occupational safety issues. The only legislate which is available on the government level are: the Law on occupational safety and health (Web reference). In our previous investigation, we adopted the questionnaire developed by Lin et al. (2008), which they used for the safety climate measurement at workplaces in China. This questionnaire was the base for further adaptation of this model to the Serbian context (Milijić and Mihajlović, 2011). The aim of this earlier investigation was to start the process of developing the safety climate questionnaire that can be used in Serbia.

Considering that the safety climate issue is too broad to be investigated in one research, especially in the narrow field of Serbian economy, it was decided to focus on the following items. Being a small country in the South East part of Europe, with the population of nearly 7 million, Serbia is not a country which has got all industrial sectors equally developed. The most developed sectors are in the field of mining, metallurgy and food industry based on large agricultural potentials. The other industrial sectors are to some extend present, only in some regions of Serbia. The research presented in this paper, was conducted in the central region of Serbia, where the companies are dealing with the following industrial sectors: electrical construction, cement production, shoes manufacturing, food industry, PVC joinery, cosmetic industry, textile industry, recycling and furniture industry. Considering the different scopes of workplaces in all presented industrial sectors, which were investigated, it was supposed that the obtained results will be useful for supporting the hypothesis H_1 (the type of organization has some influence on safety climate indicators). Such interdependence was also investigated and proved by Silva et al. (2004). Also, as another important influence on safety climate was to investigate the position of the employee in the firm. This way, the second research question could be formulated as (hypothesis H_2). "Does the position of the employee in the firm have an important influence on safety climate indicators?" Such a correlation was previously investigated and proved by Prussia et al. (2003), Findley et al. (2007) and Beus et al. (2010), where the most important safety climate measures for the occurrence of the injuries at different work places, were considered.

2. Methods

2.1. Investigated population

The study was conducted in central Serbia (the Morava region). The current study was conducted in nine different organizations representing nine different industrial sectors in Serbia. Considering the fact that Serbia is a small country and that it does not have a large number of industrial capacities in different industrial sectors, it was decided to study the organizations belonging to different industrial fields at the same time. The previously defined final questionnaire (Appendix A) was used for evaluating the opinion of the employees in these organizations.

The final questionnaire has been based on the results of the initial research presented by Milijic et al. (2013). The starting form of the questionnaire was based on the research of Lin et al. (2008), used in the context for the safety climate measurement at workplaces in China. According to the findings presented by Milijic et al. (2013), some regrouping of the questions in the original seven factor loadings was performed. The regrouping resulted after the initial factor analysis, which is described in detail in Milijic et al. (2013). Also, additional demographic subgroups (position in the firm and educational level) were introduced in the final questionnaire. In the initial research, it was concluded that these two items also influenced the final safety climate measurements. This was again confirmed in the results presented in this paper. Considering the fact that Serbia is a small country, the number of potential candidates to be included in the survey, was not that big. This way, all the employees of the companies who were included in the survey, were potential subjects. They were all informed about the survey by the managers of the company and asked to participate. Hence 1311 individual workers, who had been potentially exposed to occupational hazards in those organizations, were selected as the study subjects. The questionnaires were distributed to organizations and 1098 questionnaires were retrieved with a total response rate of 83.75%.

2.2. Questionnaire

Five-point Likert-type scale (1 = strongly disagree to 5 = strongly agree) has been used for collecting the workers'