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ORIGINAL ARTICLE

Evaluation of Health, Safety and Environment (HSE) Culture

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ABSTRACT

Studies have determined that the application of technical safety measures is not adequate to protect human, economic and environmental assets in industries. Therefore, promoting Health, Safety and Environment (HSE culture), as an alternative approach, is of great importance. The aim of this study was to evaluate and manage HSE culture among employees of an industrial sector in Iran. This descriptive-analytic research was carried out during the years 2009 and 2010. The statistical population included ten subsidiaries of the industry. To gather the required data, an HSE culture questionnaire was developed. SPSS software was also applied to analyze the data gathered. Data analysis determined that the mean of HSE culture scores was 262.7. Considering the borderline between the negative and positive HSE culture (279), it is inferred that 79.4% of personnel culture scores was negative. Finally, the study concluded that to improve safety culture in an organization, not only psychological and personal factors but also organizational and environmental factors should thoroughly be investigated. In this way, the actual problems would be identified, appropriate problem-solving methodologies be implemented and, ultimately incidents rate be reduced.

Keywords: *Safety, Culture, Management, Environment, Health*

INTRODUCTION

Considerable progress has so far been made towards engineering science; the physical causes of incidents. It is now generally accepted that individual unsafe behaviors and pervasive organizational defects lie behind the majority of the catastrophic accidents. Although many of "Does and Don'ts" have been anticipated in HSE rules, procedures and management efforts, people do not always do what they are supposed to do. Some people have negative belief in HSE which adversely affects their behaviors. This undermines the system of multiple defenses that an organization makes and maintains to guard against injuries to its employees and damages to its property. The HSE management system is essentially a social system, wholly based on the staff operating it. Its success depends on three items: its scope, whether employees are informed about it, and whether they are well disposed towards it (i.e. committed to making it work). The concept of "HSE culture" has evolved as a way of formulating and addressing this new focus. In other words, in order to contribute to the overall reduction of work related accidents, occupational HSE has been studied from different points of view [1]. Whether technical or psychological, these viewpoints are leading to the improvement of a positive HSE culture.

The term "safety culture" first made its appearance in the 1987 OECD Nuclear Agency report (INSAG,

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Table 1. Score and status of health, safety and environment culture dimensions in the units under study

No.	HSE culture dimension	Obtained score	Distinction between the score and the borderline	Cultural situation
1	Training and perceiving health and safety issues (HSE training)	24.3	27	negative
2	priority of production versus safety	32.4	36	negative
3	Level of personnel involvement in health and safety issues (worker participation)	14.4	15	negative
4	Incidents, accidents and near misses (System safety and risk management)	23.6	27	negative
5	Organizational commitment / management commitment to safety and health (HSE commitment)	51	44	positive
6	Supervisors, direct managers and production management (HSE leadership)	20.2	21	negative
7	Safety and health rules, guidelines and procedures, and obstacles to safe behaviors (HSE rules)	32	33	negative
8	Employees' attitudes towards safety and overall health status (HSE awareness and attitude)	38.8	42	negative
9	Violation and disregard of safety rules and regulations (HSE encouragement and punishment)	26.1	24	positive

1988) on the 1986 Chernobyl accident. Gaining international currency over the last decade, it has been used to describe companies' atmosphere or culture in which HSE is understood to be the number one priority [2]. The concept of HSE culture is often introduced separately from an organization's other characteristics, such as the work schedule, technology, business strategy and financial decision-making [3]. Therefore various definitions of HSE culture abound in the academic HSE literature. Chinda et al. (1989), for example, defined it as a set of belief, norms, attitudes and social and technical practices that are concerned with reducing the exposure of people to conditions considered dangerous or injurious [4]. Frank (2007) defined HSE culture as the ideas and attitudes that all members of an organization share about risk, accidents, environmental protection and ill health [5]. All these definitions are relatively similar as they can be categorized into normative belief and perspectives; each focuses on the way people think and/or behave in relation to HSE.

Obviously, the first step in promoting a culture of HSE in an organization is to determine the current situation of HSE culture. Having identified the strengths and weaknesses of HSE culture, planning will be possible to improve the level of culture. Therefore, the main objective of this study was to evaluate HSE culture among employees of a defense industry in Iran. The study also assessed the factors affecting the culture.

MATERIALS AND METHODS

Statistical sample

This study was performed in ten industrial units as subsidiaries of Iran's Defense Industry during the years 2009 and 2010. A pilot study was carried out prior to the study to determine the required sample size. Considering the mean, minimum, maximum and standard deviation of the HSE scores as well as the maximum error allowed, which is 4, the actual sample size of 637 was obtained.

Questionnaire

HSE culture questionnaire was initially developed based on the review of the relevant literature. Previous studies have identified nine main dimensions of HSE culture: HSE environment [6], HSE rules [7], HSE commitment [8], HSE training [9], HSE systems [10], HSE leadership [11], System safety and risk management [8], HSE encouragement and punishment [12], Workers participation [13], HSE awareness and attitude [14], and priority of production versus HSE [5]. It is noteworthy that some of the items were slightly changed to fit the organizational structure of the industry under study; for example the term supervisor was changed to HSE manager. All of the questions should be answered on a 5-point Likert scale ranging from strongly disagree to strongly agree.

Procedure

The employees of the industrial units were asked to complete the questionnaire. The first page of the questionnaire emphasized that replies were anonymous, that respondent participation was voluntary, and that the questions should be answered honestly. All of ten units answered the questionnaire, however, the response rate varied from 64% to 97%, with an average of 87%.

Based on the Likert scale score calculations, the total score of each questionnaire should be compared with the average score. To show the negative or positive HSE culture, equation 1 was used, where K represents the number of questions/statements and μ is the mean score of the HSE culture:

$$\mu = \frac{5K + K}{2} \qquad (1)$$

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Table 2. Health, safety and environment culture scores in terms of the industrial units

No.	Industrial unit	Mean of HSE culture scores	Minimum HSE culture score	Maximum HSE culture score	Percentage of personnel with negative HSE culture scores
1	A	266	207	312	74. 3
2	B	264.6	211	310	82
3	C	254.9	144	302	87.2
4	D	257	181	303	85.1
5	E	264.25	163	320	77
6	F	264.6	277	306	81.9
7	G	262.1	163	322	79.9
8	H	263.3	215	301	83.3
9	I	265	232	295	80.5
10	J	259.5	158	296	86.7
Total		262.7	144	322	79.4

Green and red show the best and worst cultural situation respectively.

With respect to the fact that the questionnaire consisted of 93 questions, if the calculated HSE culture score was more than 279, HSE culture was considered as positive and a score of less than 279 represented the negative culture.

SPSS software was applied to analyze the data gathered.

RESULTS

The mean of HSE culture scores was 262.7, which was lower than the criterion calculated through equation 1 (279), and this implies that the overall HSE culture of the industries under study was negative. The minimum and maximum scores of the HSE culture were 144 and 322 respectively, with a standard deviation of 1.22. Considering the score 279 as a borderline between the negative and positive HSE culture, it is inferred that 79.4% of personnel HSE culture scores was negative. The overall HSE culture of the industrial units in terms of the main dimensions and their status is summarized in Table 1. Accordingly, apart from the two dimensions of "organizational and management commitment to HSE (HSE commitment)" and "violation and disregard of rules and regulations associated with the HSE culture of the company (HSE encouragement and punishment)", the cultural situation of other dimensions was negative.

HSE culture scores in terms of the industrial units are classified in Table 2. The Table highlights the best and worst industries with regard to the mean HSE culture scores, the highest and lowest scores obtained, and the lowest and highest percentage of personnel with negative HSE scores. Considering the mean HSE culture scores and color coding in Table 2 (green for the best and red for the worst), it is inferred that Industries A and C had the best and worst cultural situations respectively. Taking the minimum HSE culture scores into account, Industry F seemed to have the best and Industry C the worst cultural situations. Moreover, regarding the maximum scores of HSE culture, Industry G came with the best cultural situation while Industry I had the worst. According to the percentage of employees with negative HSE cultures scores, Industry A was the best (i.e. had the lowest negative percentage) and Industry C was the worst. In the next stage of the study, the linear regression was used to investigate the relationship between the HSE culture and variables affecting it. The results showed that among all the affecting variables (i.e. type of industry, employee's age, educational level, organizational position, type of employment, incident record and marital status), only the relationship between the educational level and HSE culture found to be significant ($p<0.05$).

DISCUSSION

The results showed that the overall HSE culture of the industrial sector was negative. Numerous studies have so far proven the direct relationship between the poor HSE culture and increased rates of accidents and the consequent human, economic and environmental losses [15]. For example, following the fire at the King's Cross London Underground station, researchers proposed making cultural changes in the whole organization as a requirement [16]. To prevent such incidents as Piper Alpha from occurring, creating an appropriate culture in which safety is perceived and accepted is essential [17]. Moreover, in recent years, following the frequent rail crash incidents, the emphasis on creating a positive HSE culture in organizations has significantly been increased [18]. Azadeh et al. also explained the relationship between the poor HSE culture and risk of accident occurrence, and put a lot of emphasis on developing and promoting a sound HSE

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culture within organizations [19]. According to Table 1, the most significant dimensions that made negative contributions to HSE culture are as follows:

1. Priority of production versus HSE: Creating a balance between production demands and HSE principles is one of the long-lasting challenges in industries, in which unfortunately, all too often authorities have been in favor of production demands. Meanwhile the inappropriate attitude of managers is considered to be the most significant obstacle [20]. Rundmo et al. in their study blamed the poor HSE attitude and culture for overlooking HSE principles, because of production demands; which has resulted in increased accidents rates [21]. Moreover, the results of another study placed a considerable emphasis on the significant relationship between HSE attitude and culture and highlighted that the negative attitude and culture of organizations' decision-makers has been the main cause of accidents [22].

2. Worker participation: This research, in line with that of Donald and Young (1996), suggests that workers participation is fundamental for the proper development of the cultural based system. Similarly, employees' participation leads to a decrease in absenteeism and an improvement in workers' motivation, as they feel that they are an important part of the organization, and that their managers value their belief and contributions [23]. In this case, employees are more strongly identified with and committed to their organization, contributing to its interests and profitability [24].

3. System safety and risk management: A number of studies highlighted the important role of HSE culture in determining the frequency of accidents and near misses in workplaces. One of the indications of the presence of a positive HSE culture within an organization is a comprehensive system of incident investigation [25]. This system enables any organization to systematically collect facts/evidences related to accidents and near misses, analyze them, and perform follow up activities [26]. The result of operating such a system would be reducing the accidents rate and improving the level of HSE culture in the organization [27].

4. HSE leadership: A committed leader, who is personally involved in HSE activities and takes an interest in working condition improvement, demonstrates the importance of HSE for the organization [28]. As a result, employees would comply with HSE rules and actively participate in the meetings and activities arranged to make improvements in their workplace. Several researches regarded the management policies and practices, which forms the HSE management system, as a precursor of employees' perceptions about the importance of HSE in their organization, thus contributing to performing tasks in a safe manner.

5. HSE rules: To prevent accidents and near misses from occurring, it is important to develop appropriate HSE rules. It is also important to ensure that the contents of the rules are adapted to the types of errors [29]. In the study of Brewer and Canasy, probabilistic risk assessment methodologies were proposed as a practical way of improving the contents of the rules [30].

6. Employees' attitudes towards the overall level of HSE culture: Without doubt, one of the organizational factors influencing its culture is the level of personnel's HSE attitude [31]. In other words, the personnel's HSE attitude forms their behaviors, and the direct relationship between unsafe behaviors and accident rates has been proved [26]. Moreover, due to the fact that HSE attitude is considered as an integral part of HSE culture, attitude modification can be one of the basic strategies to minimize the rate of accidents, correct improper attitudes and finally improve HSE culture [18].

The highest level of HSE culture in Industry A in comparison with the other units could result from its working environment that was mainly office based [32]. In addition, in this unit, because of creating a safe workplace, the rates of unsafe behaviors and unsafe conditions were quite low and it was less likely to have accidents, which in turn, would contribute to promote HSE culture [33]. In addition, the educational level of employees in Industry A was higher than that of the other industries in a way that the employees with post graduate qualifications was 67% whereas in the other industries, this level was 51% at its most. It is noteworthy that the relationship between educational level and HSE culture has been emphasized in many studies [34].

CONCLUSION

Negative HSE culture in organizations is considered as one of the root causes of accidents which result in great losses and disastrous consequences. It is therefore required to promote the level of HSE culture in organizations. The following suggestions may help to improve the HSE culture:

1. Periodic evaluation of HSE culture as a proactive measure as well as design and implementation of intervention plans for continuous improvement of HSE culture;
2. Design and implementation of a system of reward and punishment towards safe and unsafe behaviors;
3. Design, implementation and operation of a comprehensive system of self-reporting (i.e. involvement and participation of all personnel in HSE matters); and
4. Design and implementation of a comprehensive system to investigate accidents and near misses.

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