

## A PROPOSED MODEL FOR EVALUATE ORGANIZATIONAL SAFETY CULTURE

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### **Abstract:**

The integration of organizational behavior dimension and safety culture approaches have been supported the safety leadership development where managers are promoting proactive safety initiatives into practices. In this context, managers have adopted effective non-disciplinary, proactive techniques for enabling employees to work safely and to apply preventive measures for occupational health and safety. These was associated with a continuous improvement approach where workers and their managers cooperatively gather and analyze information and knowledge to identify systemic causes of observed risk behaviors and the associated conditions of their development, and then elaborate and implement corrective measures to nurture safety culture.

The article aims to present a propose model for the safety culture assessment (diagnosis and analysis). The model is based on the previous research conclusions that were integrated and aligned to the specific of the Romanian legislative framework and by consider relevant dimensions as: knowledge, psychological influence and legal compliance together with their relationships among the norm system, the safety management system and the safety culture. Furthermore, the model facilitates the safety culture weaknesses identification by workers and not only by managers. Collecting and structuring knowledge on such weaknesses can support the elaboration of appropriate corrective measures and related actions, which enhance the safety culture of the organization.

The presented research results is considered a preliminary step for the development of a quantitative methodology for assessing the safety culture in organizations (from different industries/dimension).

*Keywords: Safety culture, safety behavior, safety management system, occupational safety and health (OSH), model, evaluation.*

# 1. INTRODUCTION

Accidents affecting organizational systems that require high reliability can result in significant damage to the public as well as loss of life. Significant safety-related research that may improve safety has long been prioritized. The variety of efforts intended to make safety the top priority in organizations have also created safety cultures. Typically, this safety culture process requires the changing of worker awareness. The concept of safety culture was established to emphasize the importance of cultivating attitudes, among employees and within organizations, which promote safety. The Chernobyl disaster (1988) and more recent Fukushima accident (2011) further highlighted the importance of safety culture and strengthened the need to create activities to enhance the safety culture awareness of workers.

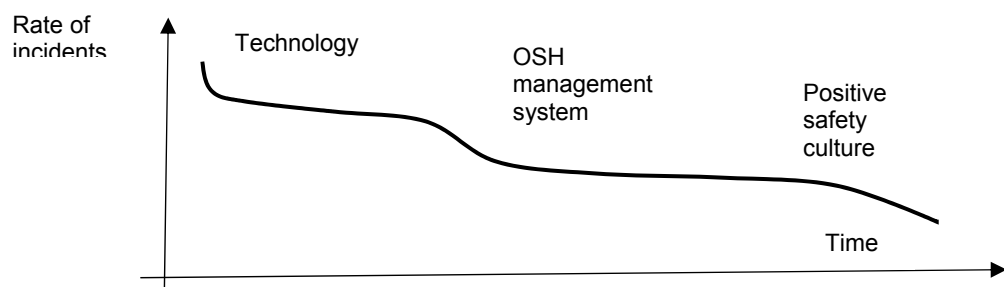
Uttal (1983) defined safety culture as "shared values and beliefs that interact with an organization's structures and control systems to produce behavioral norms"; Turner (1989) defined it as, "the set of beliefs, norms, attitudes, roles, and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious". The term *safety culture* is more loosely used to describe the atmosphere or culture of corporations, in which safety is considered and accepted as the number one priority (Cullen, 1990). According to (Zhang et al., 2002), there are several common features of safety culture:

1. It is a concept defined at the group level or higher that refers to shared values among all of the members of a group or organization;
2. It is concerned with formal safety issues in an organization, which are closely related to, but not restricted to, the management and supervisory systems of the organization;
3. It emphasizes the contributions of all members in their own positions in an organization;
4. It has an impact on the behavior of members at work;
5. It is reflected in an organization's willingness to improve safety by learning from errors, incidents, and accidents;
6. It is relatively enduring, stable, and resistant to change.

As show (Hale & Hovden, 1998), we are the third age security and health. This involves implementation of preventive measures from three perspectives: (a) technological development including up-date and implementation of protection intrinsic technical means; (b) occupational safety and health (OSH) management system definition and continuous improvement; (c) development and nurture the OSH culture. All these perspectives are converging and inter-operational to fulfill the primary goal of a preventive behavior related to avoid accidents at work and support workplace wellbeing. According to (Kim et al., 2016) the above mention perspectives related to the preventive behavior of employees occurred sequentially in time, observing that, in consideration of safety culture, the effectiveness of prevention resulted in remarkable decreases of work accidents, even if at first these decreases were timid because of psychological inertia change mentalities (Picture 1).

**Picture 1:** OSH technologies, management and culture together decrease rate of workplace incidents

Period	1980s	1980s – middle of 2000s	Middle 2000s - today
National level	Legislation and labor inspection +		<i>National policy, system for workers' health</i>
Workplace level	Technologic approach	Technology + OSH management system	Technology + OSH management system + <i>Positive safety culture</i>

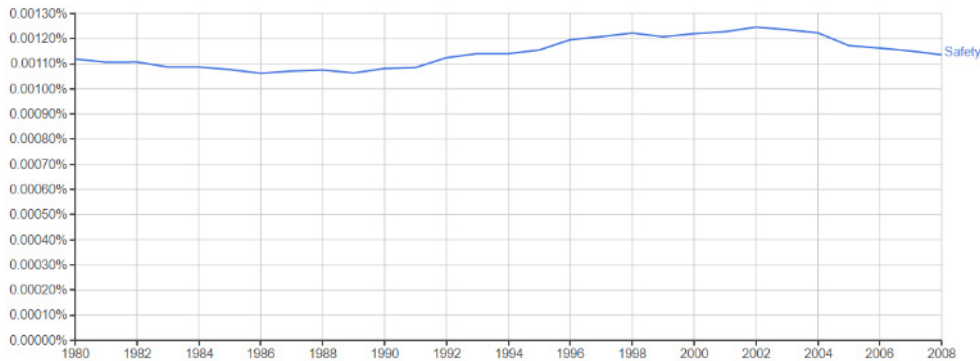


Source: Kim et al., 2016

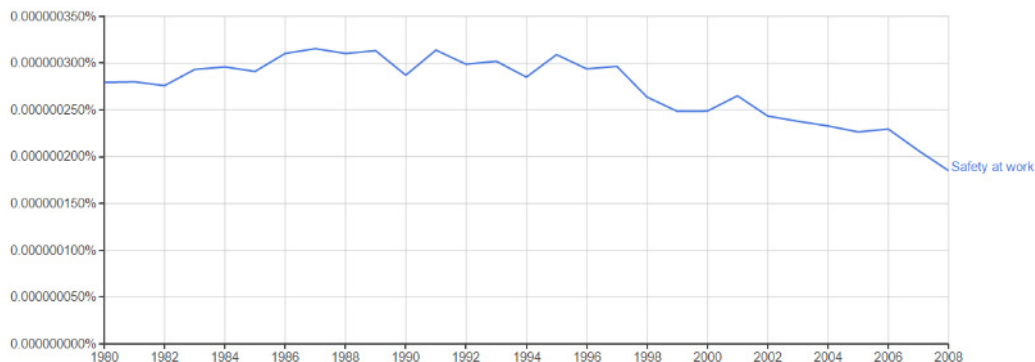
## 2. RELEVANCE OF THE SAFETY CULTURE CONCEPT

The increasing demand and interest on safety culture concept can be demonstrated by using specific tool of Data Mining. In the following are shown the relevance of the three topics (“safety” shows in Picture 2, “safety culture” shows in Picture 3, and “safety at work” shows in Picture 4) using the Google Books Ngram Viewer (<https://books.google.com/ngrams/>). There were considered these relevant associated concepts with safety culture one because of their representative rate of treatment in time. The software displays a graph showing how those concepts have occurred in a corpus of books (available on Google data base in English) over the selected period between 1980 and 2000.

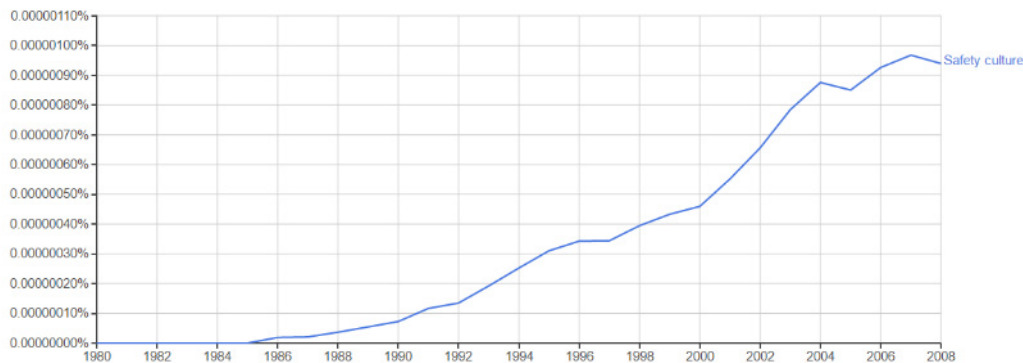
**Picture 2:** Relevance of term “safety” as result of Google Books Ngram Viewer search



**Picture 3:** Relevance of term “safety at work” as result of Google Books Ngram Viewer search



**Picture 4:** Relevance of term safety culture as result of Google Books Ngram Viewer search

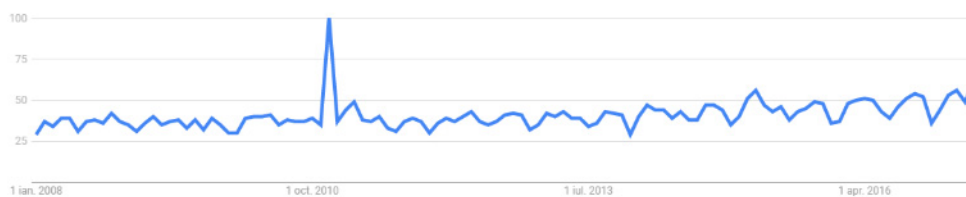


According to the represented ngrams from 1980 to 2008, the “safety” concept (Picture 2) is of high interest during the whole period. The data in y-axis show the percentage of the concept used in the sample of all books written in English and published. Paradoxically, the ngram shows the interest decreasing of the concept in the published books during industrialization (1850 - 1950). After that, the interest was recaptured and therefore the ngram shows an upward trend that is currently maintained even in the recent years. Regarding the concept of “safety at work” (Picture 3), there is a higher interest on it after 1900s but after 1997 the interest in publishing is decreasing. This could be explained by the

concept evolution and its replacing with “workplace wellbeing” in the last years. The concept of “safety culture” (Picture 4) appeared much later than the other two previous concepts (because of the Chernobyl event in 1986) and the ngram shows an increasing tendency for publishing on it in books.

The high interest level on “safety culture” has been search using Google Trends software application for Data Mining (<https://trends.google.ro/trends/?geo>), by considered global dimension of the search. Picture 5 show the trend line, which indicate a constant and high interest for the concept. In addition, the search has underlined a massive increasing interest of the public for associated concepts as: positive health and safety culture, safety culture audit (assessment), how to develop road safety culture, safety culture excellence and ladder, articles in the field, and culture balancing safety and accountability.

**Picture 5:** The public interest level for “safety culture” concept delivered by Google Trends



The conclusion on “safety culture” concept high interest and relevance for researchers and the general public is evident. This tendency motivate our research and demonstrate the importance of the concept not only from the research perspective, but most for practical purposes, in organizations.

### **3. THE PLACE OF THE SAFETY CULTURE ASSESSMENT WITHIN INTERNAL PROCESSES OSH**

The paper aims to investigate the current model for OSH culture assessment and shaping the legal framework for its implementation (according to Romania existing legal framework harmonized with the European one), deciphering the importance of this evaluation taking into account the place and role of this assessment. This creates the need for a model by considering material, quantification, and measurement of the safety culture, the OSH model necessary for system managers. This tool will aim to identify links deficit between systems and systems weakness, helping decision projection appropriate and efficient policies, capable of reducing or maintaining the level as low as possible of the number and severity of incidents at the workplace on it manages.

The assumption for the model development refers to how far OSH culture seen as having a key in preventing the risk of injury, for an efficient and proper use of this concept; the location must be disclosed and understood this concept in the managerial, legal and interdependent behavior in the following configuration (Picture 6):

1. OSH culture place and role concerning the legal system and behavioral management;
2. Assessment location OSH management level (monitoring and control), through legal and behavioral elements
3. Relevance and simplicity evaluation methods and questionnaires send to workers, in order to facilitate the assessment behavior done by managers or responsible for OSH.

#### **3.1. The place and role of OSH culture about the legal system and behavioural management (the inner circle of the scheme "legal instruments")**

One year before joining the EU in 2007, Romania has adopted the European Directive 89/391/EEC by integrating it into the Law 319/2006 (the national law for OSH), which, along with many other obligations for employers, provides the following principal requirements to prevent accidents and occupational risks:

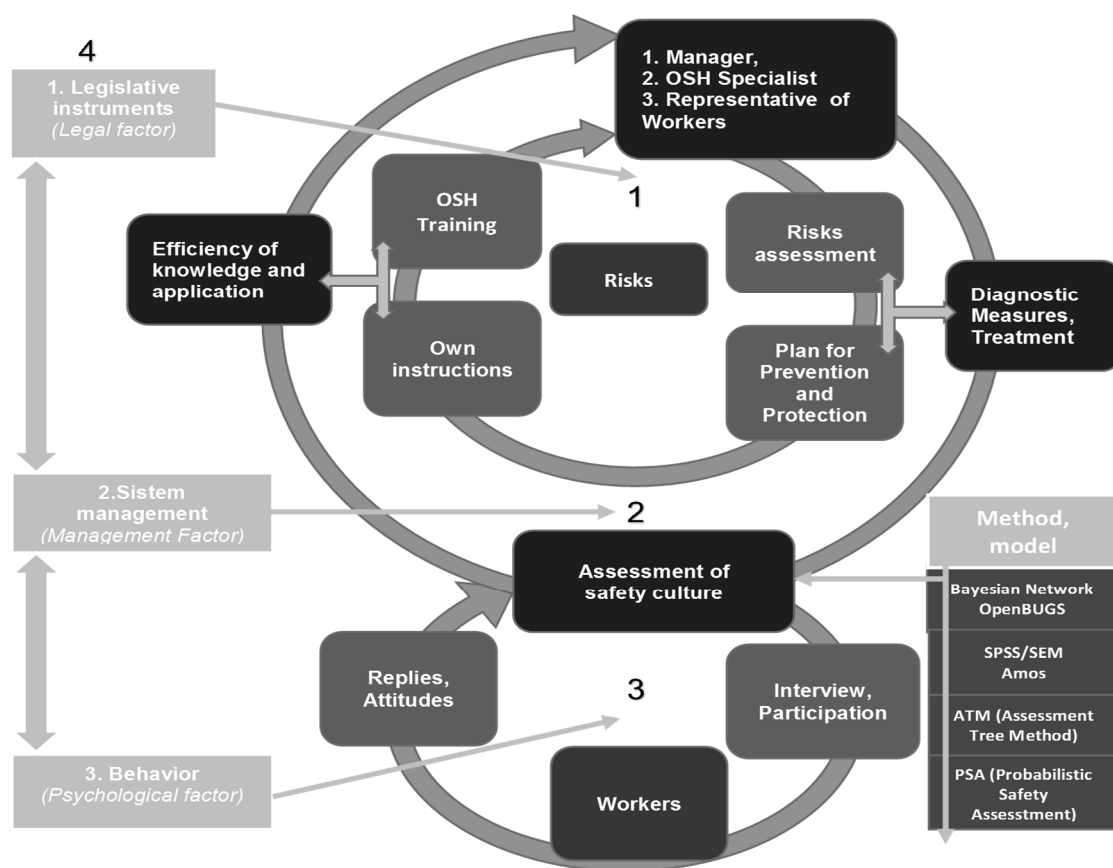
- Implementation of measures for evaluating the risks and be in possession of such risk assessments of OSH, according to Article 7 (3) b. + para. (4) a) + Article 12, para. (1) a) + GD 1425/2006 Article 15, para. (1) item 1, para +. (3) + Article 71;
- Prepare a plan for prevention and protection measures consisting the technical, health, organizational aspects, according to GD 1425/2006 Article 13 b + 46;

- Develop their instructions appropriate for the completion and implementation of OSH regulations, according to Article 7, par. (3), e) + Article 13, e) + GD 1425/2006, Article 15, para. (1), item 3;
- Provide information and training for workers with appropriate instructions, according to Article 7 para. (1), c) + Article 13, point h) + Article 16, Article 21, Article 20 + GD 1425 / 2006 art. 74-100.

Regarding the legal obligations and responsibilities there shall be established primarily, a responsible specialist on OHS, which has advised by workers representatives, too. Legislation has regulations stimulation and completion of a management system, supporting it measures compliance and coercion OSH structures have a minimum framework for maintaining managerial control risk of injury. According to OSH Law 319/2006:

- Article 6 para. (1): The employer must ensure the safety and health of workers in all aspects of work;
- Article 7. para. (2): The employer is obliged to pursue adjustment measures to take account of changing circumstances and improving existing situations;
- Article 7. para. (4), b): Working and production prevention methods implemented by the employer will ensure the improvement of security and health protection of workers and will be integrated with the overall business processes and they will establishment at all hierarchical levels.

**Picture 6: The safety culture assessment place in organization**



### 3.2. The safety assessment place at management level (cycle outside the scheme "System Management")

Legal framework noted above, does not establish barriers, but only impose minimum adequate prevention measures, leaving the free will of each economic entity sizing for effective prevention. Organizations' top management will implement adequate and specific OSH measures affecting the development of a positive safety culture. Thus, the role of the safety culture assessment is to move to another level of risk control involving the creation of policies, checks, continuous updates to the realities of the environment. A successful business management is not just looking to the formalism of legal

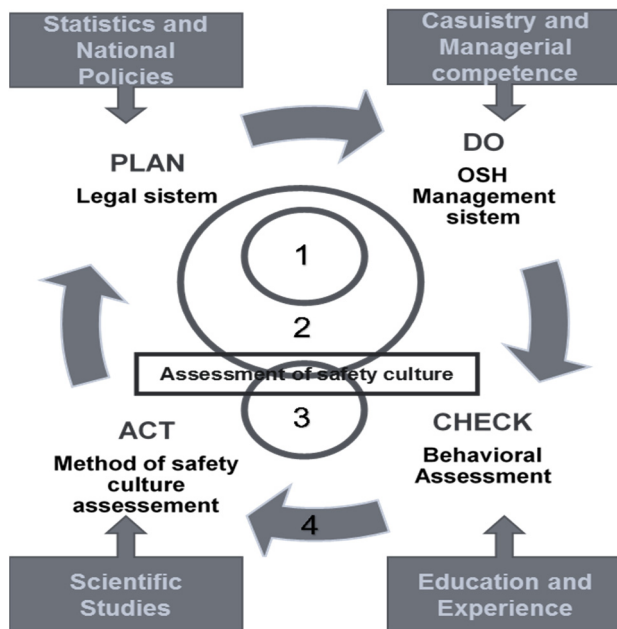
compliance, but will continually seek further efficient measures of prevention, which will emanate directly from working conclusive.

Manager and lower hierarchical structures must take into account the feedback came from workers who try to protect themselves, and not only to the systems they govern. Only in this way, there will be possible to optimize the systems, so that they meet the real needs and appropriate prevention, thereby evaluating safety culture will shift from reactive to proactive or sometimes happy prevention (proactive towards prevention generative).

Legislation is addressing, in this assessment, directly to the mains risks and the workers protection:

- OSH Law 319/2006, Article 13, paragraph f): Ensure and control knowledge and the implementation, by all employees, of the prevention and protection plan established in the organization, and the legal provisions on safety and health at work;
- OSH Law 319/2006, Article 18 para. (1) Employers shall consult workers and/or their representatives and allow them to participate in discussions on all aspects related to safety and health;
- GD 1425/2006 - Article 75. Training in the OSH field at work aims as employees to acquire the knowledge and skills on the topics (within the industry and processes specifics).

**Picture 7:** Assessment of safety culture in interdependent Deming cycles



The process of adopting and implementing the above mention legal requirements and obligations, has conducted to the representation of the Deming cycle, as following (Picture 6):

- Cycle 1 - Compliance with legislation;
- Cycle 2 - Management evaluation;
- Cycle 3 - Questioning of workers to establish security behavior that is intertwined and affect the measurement management;
- Cycle 4 - Encompasses the previous three, which influenced from the outside by: casuistry and managerial competence; education and experience; scientific studies; statistics and national policies.

### 3.3. Tools (questionnaires) used to assess OSH behaviour

These assessments took into account variables and elements that were intended to be measured by surveys workers. The literature reveals several methods to assess the level of safety culture. They were mainly based on the psychological factor that tries to be extracted from questionnaires and measured by statistical methods and probabilistic projection of the weak links between systems or poor assessment behaviors. These behavioral assessments come to complete structural evaluation and safety management to help monitor the safety culture.

Most common methods and tools used for the OSH assessment are based on the following valuation methods and tools:

- a. Bayesian Network (García-Herrero et al., 2013; Lee & Seong, 2017) – OpenBUGS software
- b. SPSS / SEM – Amos software (Statistical Package for the Social Sciences / Structural Equation Modelling) (Vieira, 2017; Gopang, et al., 2017; Mojapelo, et al., 2016)
- c. ATM (Tree Assessment Method) (Warszawska & Kraslawski, 2016; Ayomoh & Oke, 2006)
- d. PSA (Probabilistic Safety Assessment) (Spitzer & Schmocker, 2004), or PRA (Probabilistic Risk Assessment) (Mohaghegh & Mosleh, 2009)

As it can be seen, the basis of the safety culture assessment consider questionnaires with specific dimensions. Thus, the key for safety culture assessment and characterization is related to a designed questionnaire with adequate dimensions or variables for a specific industry (legal framework included specific requirements and mandatory aspects of OSH for each economic field or work type). Based on these studied methods and tools, there have been designed the proposed model for the safety culture.

#### 4. THE PROPOSED MODEL FOR THE OSH SAFETY CULTURE ASSESSMENT

For the questionnaire adaptation to Romania OSH specifics there have been proposed a plurality of blocks of OSH safety culture that have to be quantified and measured. The purpose is to find a broad, easy to interpret range of elements and join them in an endeavor to achieve an integrated conceptual model for assessing the OSH safety culture (Table 1).

**Table 1:** The considered blocks of the OSH safety culture assessment

Dimensions			
Knowledge		Psychological influence	Legal compliance
Characterization issues	1. Professional trainings (competencies, abilities, skills, experience gained with seniors in the profession, practice / habits / routines, taboos)	1. From a social group (life partners, relatives, schoolmates, neighbours, friends, membership with same social status, membership of a generation / age)	1. Unilateral – making connection between certain statements and actions / reactions / events (understanding, motivation, awareness)
	2. Specific OSH instruction, appropriate quantitative and qualitative which they acquire (behaviours, responsibilities, risk management, reactions, perceptions, attitudes, opinions, values, principles of defended, visions, strategies, procedures, rules)	2. From a professional group (teachers/trainers, management policies, coordinators/chiefs, collegial or partnership behaviour, association with a brand, organization culture)	2. Imposed – accession agreement (quality standards, legal regulation, internal procedures, individual employment contract with OSH job tasks, OSH own instructions, internal rules)

The considered dimensions (knowledge, psychological influence and legal compliance) and associated issues for their characterization will be detailed in the designed questionnaire that will be applied for industrial (manufacturing) companies of different size in Romania. The chosen dimensions were inspired by the conclusions of (Leitão & Greiner, 2017; Chinda & Mohamed, 2008; Gopang et al., 2017). These conclusions were integrated and aligned to the specific of the Romanian legislative framework and for defining the relevant dimensions together with their relationships among the norm system, the safety management system and the safety culture. Furthermore, the model facilitates the safety culture weaknesses identification by workers and not only by managers. Collecting and structuring knowledge on such weaknesses can support the elaboration of appropriate corrective measures and related actions, which enhance the safety culture of the organization.

#### 5. CONCLUSIONS

After a brief description of the safety culture concept there have been demonstrated the relevance and importance of it using Google Books Ngram Viewer and Google Trends software. Both have underlined

the major increasing of the researchers, practitioners, employers and employees for safety culture definition and development. Later on, there have been define the role and the place of the safety culture assessment within internal organizational processes of OSH. The analysis has considered OSH management and the existing legal framework in the field. Furthermore, the brief description of the methods and tools used to assess OSH behavior has concluded that an adequate, well designed questionnaire will be the best tool used for the safety culture assessment. Finally, there have been presented a proposed model for the safety culture assessment.

The presented research results is considered a preliminary step for the development of a quantitative methodology for assessing the safety culture in organizations (from different manufacturing companies).

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