SAFETY MANAGEMENT SYSTEMS AND SAFETY CULTURE ASSESSMENT

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ABSTRACT: The paper inhere defines the basic features of the contemporary safety management systems (SMS) which are a must in the contemporary companies, especially in ones where there is a high rates of production induced risks. The paper also clarifies the differences and similarities between safety management systems and the safety culture within the companies. Typical instruments for assessment of safety culture are described with their advantages and disadvantages. Universal open and close format questionnaires are developed for safety culture assessment.

KEY WORDS: Safety management system (SMS), Safety culture (SC), prevention, Safety.

INTRODUCTION

SMS-s provides a systematic set of activities to identify hazards, control risks and apply safety technical and organizational measures in order to maintain assurance that safety risk controls are effective.

In the general case the safety management system is implemented into the company or the organization in a way that it becomes a part of the safety culture of the personnel and the overall way workers do their jobs [3].

SAFETY MANAGEMENT SYSTEMS (SMS)

The safety management systems (SMS) include measures and activities, fulfilled by the organization for achieving strong safety culture.

SMS is a closed loop of activities: identifying potential hazards, analyze risk, evaluate hazards, assess risk, perform improvements, safety audits and inspections and the entire process is uninterruptible.

SMSs have two major goals:

➢ To improve the safety in the organization by means of planning, control, and audits of all associated with the occupational safety activities in the company under normal operation conditions, transient conditions and fault situations;

➢ To encourage and maintain a strong "culture of safety" and develop and strengthen good attitude and behavior of individuals and teams to safety, in order to allow them to perform their duties safely;

SMS in each high risk production is being developed, applied and assessed continuously. It is a major responsibility of the certain organization performing the respective activities.

It is obvious that SMS and safety culture have close relations in between but they are quite different one from the other (fig. 1).
Safety of culture represents the commitment and attitude of an organization to achieve safety.

SMS represents the competence to achieve safety.

SMSs must meet the requirements of the respective legislation and supervisor authorities. The general purpose of the system is to guarantee safety and protection of the individual, the society and the environment.

Along with that SMS must comprise and the “Communication relations” between the company and external organizations, international agencies, suppliers, research institutes and control authorities. In that way the control authorities have guarantees that the organization has achieved high standards of safety.

The structure of a typical SMS is shown in fig. 3.

The framework of a contemporary SMS must include certain features that companies must incorporate [3]:

1. **Company safety politics and objectives.**
   - Commitment to safety management and responsibilities
   - Safety accountability
   - Maintenance of qualified safety personnel
   - Coordination and optimization of emergency evacuation plans
   - SMS documentation

2. **Safety risk management**
   - Identification of hazards
   - Risk assessment
   - Safety assurance

3. **Safety performance monitoring and measurement.**
   - Management of changes related to safety
   - Uninterruptible improvement of the SMS

4. **Promotion and maintenance of safety.**
   - Training and education
   - Safety communication
SAFETY CULTURE ASSESSMENT

Safety culture evaluation is performed mostly by questionnaires. However questionnaires are not absolutely relevant for defining the actual condition of safety culture [5]. They define the current state of safety attitudes, called safety climate.

“Since Safety Climate is a measure of what is occurring in the instant, it is directly influenced by events that have recently occurred” [6]

It seems that most of safety surveys and questionnaire assess exactly safety climate rather than culture and culture appears to be shared values, beliefs and aptitudes between employees being developed for years within the organization.

So questionnaires have to be composed professionally in order to expose those attitudes that are commonly shared throughout the entire organization and give information in general what corrective measures and actions have to be made to improve safety.

Questionnaires are normally composed of questions divided in thematic fields providing employees’ views on various aspects of safety.

After the survey data is processed and transformed in analytical form by means of different scales. The following is interpretation of results and assigning of corrective actions to improve safety.

There are three approaches used by researchers for building questionnaires:

- **Descriptive approach** – it could be used as a starting point. Questionnaires are made in the base of normative requirements and theoretical background;
- **Pragmatic approach** – Results from previous surveys and researches are combined in order to compose more advanced questionnaire;
- **Confirmatory approach** – New surveys and questionnaires are made trying to confirm scales in previous researches.

**TYPES OF QUESTIONNAIRES**

1. **Open format questionnaires** – they consists of open-ended questions. The answer of employee is required in written form.
   - **Advantages**: Better relevance of results, employees express their opinion in details; obtaining of suggestions for safety improvement that could reach management and might be discussed later; Suitable for qualitative analysis
   - **Disadvantages**: It is hard to scale results. Processing of data is strongly complicated; Not suitable for quantitative analysis; Time consuming;

2. **Closed format questionnaires** – Employees are required to choose a certain answer among multiple choice answers. Specific types of closed format questionnaires are dealing with statements, where employees must indicate the extent to which they agree
with the respective statement by choosing a number from a scale;

- **Advantages:** Ease at performing preliminary analysis; Ideal for calculating statistical data and percentages; Good for quantitative analysis; Good for estimation of tendencies and deviations in time of important indicators, opinions etc. related to safety; Saving time; Fast processing of data;

- **Disadvantages:** Often do not represent the actual situation; Efficiency depends on quality of questionnaires, quality of scaling models, frequency of their application and how often one and the same questionnaires are used in consequent surveys;

3. **Mixed format questionnaires** – They are a combination of closed and open-format questionnaires and have the advantages of both of them.

A quality questionnaire should include an open-ended question at the end of the questionnaire or at the end of each thematic section that can be used for feedback and/or suggestions for improvements from employees.

**UNIVERSAL QUESTIONNAIRE FOR SAFETY CULTURE ASSESSMENT**

An open-format questionnaire list has been developed in order to be used for assessment of safety culture and safety management effectiveness in an organization regardless of its branch and type of industry.

It has to be notified that the provided list of question is not universally detailed, since it is not intended for a particular type of industry. The main idea of this questionnaire is not to get positive or negative answers but provoke the thinking of inquired employees and to make a self-assessment regarding the achieved level of safety and the efficiency of the SMS and the quality of safety culture within the organization.

The developed questionnaire list consists of thematic groups of questions:

I. **Involvement of government and safety control authorities in occupational safety**

1.1. **State commitment to safety.**
(1) Does the legislation cover all aspects related to occupational safety?
(2) Are there barriers for application of safety control activities?
(3) Do legislation and government documents pay enough attention on occupational safety in the industry?
(4) Does the budget of control authorities take into account the inflation rates related with industrial development? Is there enough funding that allows hiring of highly qualified and competent staff?
(5) Does government provide sufficient funding for safety research? Are safety research results shared with other countries?
(6) To what extent is possible the free exchange of occupational safety information with other countries?
(7) Does the government maintain a system for registration, analysis and investigation of accidents in industry?
(8) Are there examples of unauthorized interference of state control authorities with technical issues that relate to safety?

1.2. **Operation of control authorities;**
(1) Are the objectives of safety control authorities clearly defined, so that they are not too general or straight? Do they allow a balance between innovations and best practices?
(2) Is the position of competence authorities required about issues with safety normative acts and regulations?
(3) Is there a predictive and logical system to deal with issues that require reconsideration of safety and economic factors?
(4) What is the number of delayed projects or production losses due to lack of clarity in legal requirements or lack of in time decisions on safety control authorities?
(5) Does the practice of safety control authorities correspond generally to the safety standards objectives in different sectors of industry?
(6) Is there a program for training and education of safety control authorities’ staff?
(7) Do safety control authorities participate actively in international activities related to occupational safety?
(8) Are reports on issues important to safety published regularly by safety control authorities?
(9) Do safety control authorities publish periodic general summaries about safety indicators?
(10) What are the relations between safety control authorities and occupational health services? Is there an appropriate balance between formality and direct professional relationship?
(11) Is there mutual respect between safety control officers and the company based on shared level of competence? What part of the technical staff within the safety control authority has proper experience?
(12) Are there regular joint meetings and discussions about the experience and problems within the organization and the business impact of actions performed by control authorities over them?
(13) To what extent safety control authorities rely on the internal safety management and maintenance in the organization?
(14) What is the degree of presence of safety control authorities in the company?

II. Politics and practice of the employer in order to guarantee safe working conditions within the organization, definition of responsibilities, staff training, transparency upon safety issues in the organization;

2.1. Politics of safety in management level
(1) Are management polices and objectives regarding safety public? Are they clear? Does the company policy express priority in maintenance of high levels of safety?
(2) Are employees taking attitude to safety related polices and questions?
(3) Does the organization management have a concept about safety culture?
(4) Are the management and workers familiar with safety policies and can you give examples of their understanding?
(5) Does the organization management have any experience in the field of occupational safety?
(6) Are questions and issues related to safety discussed and included in the agenda of management’s meetings?
(6) Are representatives of workers allowed to attend in discussion of issues related to safety?
(7) Is there operative Safety service (department) within the company, which reports their conclusions about safety on management level?
(8) Is there a company manager whose primary duty is to ensure the safety at work? What is the organization of the process for maintaining health and safety in the organization? What is the influence of the head of safety department within the organization, compared with the heads of other departments?
(9) Are there periodical discussions on management level that discuss the amounts of resources needed for maintenance of safety? What are the results?

2.2. Determination of responsibilities.
(1) Are the responsibilities for safety clearly defined and distributed?
(2) Is the responsibility about safety of the chief manager clearly defined?
(3) Are documents defining responsibilities about safety discussed periodically and updated? What are the results?

2.3. Safety training and education
(1) In cases of training and prequalification of workers in responsible positions: Is it a practice job descriptions to be approved and adopted only on paper?
(2) What is the positive / negative statistics? What part of working time is spent on staff training and education? Is that time enough for training?
(3) What resources are allocated for instruction and training of employees in the field of occupational safety?
(4) Is the quality of curricula for staff safety training evaluated on management level?
(5) Is there periodical analysis to diagnose suitability and effectiveness of training courses?
(6) How often the schedule of planned staff safety trainings is changed or influenced due to production requirements?
(7) Do employees understand the importance of their responsibilities about safety?
(8) Are employees trained and prepared for the consequences of wrong actions on the safety and health of workers and disturbances of the production process?
(9) Do safety training courses pay enough attention on the importance of safety instructions and procedures? Are safety instructions reminded regularly? Are there training in violation of safety aspects?
(10) Are there examples that workers could give about training flows and errors that has led to a change in training programs and safety instructions?
(11) Are there questions related to safety culture included in safety training curricula?

2.4. Selection and employment of heads of departments
(1) Is it realized by staff that the attitude to safety is important in the selection of leaders?
(2) Are concrete measure related to occupational safety included in the annual evaluation of job descriptions?
(3) Can you give examples where the attitude to safety has been an important factor in the choice of heads of departments?

2.5. Analytical review of the safety characteristics
(1) Is there a system that takes into account the indicators of safety and the programs for increasing the level of safety?
(2) Does the staff understand the indicators for safety?
(3) Are the leaders familiar with the trends of change in the indicators of safety and the causes for that?
(4) What is the organization for reporting events related to occupational safety in the company? Are there formal ways to assess these events and get experience from them?

2.6. Public characteristics of safety
(1) Are there meetings of the management personnel periodically convened by the director that are devoted exclusively to safety issues?
(2) Is it allowed for workers' representatives to attend such meetings?
(3) At these meeting: Is it a practice significant safety problems to be discussed and solutions and experience of similar companies to be taken in consideration?
(4) Is there a system for reporting individual human errors? In what way the information for these errors is provided to staff?
(5) Is there a bonus and encouragement system within the company and does it
include factors dependent on safety characteristics?

2.7. Collaboration and relations between the head of the company and safety control authorities.

(1) Are there sincere and open relations in-between and are these relations still official enough?
(2) What is the organization for access of safety control authorities to documentation, equipment, front line personnel?
(3) Are reports that are requested by safety control authorities timely prepared and provided?
(4) How can you describe the level of communication between the company and the safety control authorities?
(5) Does the company director meet on regular basis representatives of the safety control authorities?

2.8. Position of leaders and their attitude to safety

(1) In cases of obvious conflict between safety and expenses or between safety and production rates: Does the managers discuss the problems with workers in order to solve them?
(2) Is there a clear commitment of leaders to safety culture and is it demonstrated? How? What practical steps are taken to support the commitment of heads of departments to safety culture?
(3) What is the attitude of managers to inspections and summaries about safety and to checks related to their activities? Do they discuss the results of such inspections and checks with their staff in order to eliminate possible flows and disadvantages?
(4) Is the staff attitude to safety evaluated by the management on regular basis?
(5) Is it a practice management to encourage and stimulate staff members for their commitment and contribution in regard with safety?

(6) What is the reaction of management on violations of safety procedures, instructions and human errors?
(7) What system exists for assessment of leaders’ achievements and disadvantages in the field of safety? Is that system effective?
(8) Is there participation of leaders and management in training courses along with staff where safety policies and safety instructions are explained? Does management supervise and control the content of safety training courses? How important for managers is the level of staff competence, knowledge and skills?
(9) What is the attitude of management to the working conditions at the working place?

2.9. Position of individual workers and their attitude to safety.

(1) To what extend the staff is aware about management commitment to safety culture?
(2) Do the staff know what are the consequences and the safety issues that may occur after their wrong actions and/or human errors? What about wrong actions of other workers?
(3) Can the staff clearly define their responsibilities? Can the staff rely on documents in which these responsibilities are clearly set?
(4) Are all safety instructions and procedures strictly observed and followed even in cases where faster methods could be applied?
(5) What steps are taken by staff if they see action, which could compromise safety at work? (6) What is the attitude of staff to their own errors that may violate safety?
(7) What should a worker do if under working conditions notice that a certain procedure or instruction prescribed by management is not correct?
(10) Is there a system where workers can report errors that are important to safety and make recommendations for improvements? Is this system used for reporting of personal errors? Are no damage cases reported?
(11) Does the personnel react positively on analysis regarding safety issues and do they collaborate efficiently in the searching of causes and making of improvements?
(12) Is the staff familiar with the system for encouragements and punishments related to safety?
(13) Do the staff participate actively in safety training and education courses using every opportunity to improve their competence? Are workers responsible to training and do they participate in discussions?
(17) Does the personnel interrupt work for reconsidering in cases of unexpected situations? What is the reaction of staff about the need of training to respond to such situations?
(18) What is the attitude of staff to safety summaries and safety inspections concerning the sphere of their activities?
(19) Does the staff share their experience with other workers or groups? What examples could you give about that?

III. Collaboration with research and design organizations

3.1. Research contribution to safety analysis
(1) To what extent the researchers understand how the results of their work will be used in safety analysis? Are they familiar with the way their data will be extrapolated or interpolated in cases when parameters are beyond the range under which the experiment has been performed?
(2) Do researchers find drawbacks or limitations in their results?
(3) Is there a policy of systematic publication of research results in scientific magazines where safety experts are used as referrers?

3.2. Occupational safety analysis in projects verification
(1) Is there verification and assessment of the safety design programs in certain conditions?
(2) Are project constraints taken in consideration at work?
(3) In what areas external verification of the project is used in addition to the own capabilities?
(4) Where are described the role and the responsibilities of groups performing project verification?

As seen above, the presented open-format questionnaire is very detailed and could represent a real snapshot of the safety culture within the company. From other hand the answering of all included questions is quite time consuming and could result in boring the employees. In addition, the qualified personnel that will be engaged with processing of information would experience significant difficulties also.

A better approach is to compose mixed-content self-assessment questionnaires according to certain safety characteristics. Each of these questionnaires is prepared with closed-format questions and a single additional open question that requires the written answer of the employee.

Such questionnaires for self-assessment of safety culture are presented in the appendices regarding two major characteristics:
- “Safety is driven by knowledge” – appendix A
- “Leadership for safety is clear” – appendix B

CONCLUSIONS

Questionnaires are widely used for assessment of safety culture. It is obvious
that implementation of open-format questionnaires is not the best option. The reasons for that were mentioned above:

- Filling in written answers is extremely time consuming and boring;
- Processing of results is severely complicated;
- It is hard to scale results;
- Results are not suitable for quantitative analysis;

It is assumed that the developed open-format questionnaire will not be used in its pure form.

Its completeness is used as a base for composing of mixed-content questionnaires for self-assessment of different characteristics of safety culture. The use of additional open questions at the end of each questionnaire implements in the survey the advantages of open-format questionnaires.

The provided questionnaires in the appendices assess only two safety characteristics and use a 5 grade evaluation scale, suitable for quantitative analyses and statistics of results.

The future objectives are mixed-content questionnaires to be composed regarding a full range of safety characteristics and the entire survey system to be applied in practice.

REFERENCES


