

An OH&S Management System as a Source of Information

**Joanna Ejdys
Agata Lulewicz-Sas**

Faculty of Management, Białystok University of Technology, Białystok, Poland

The concept of an occupational health and safety management system (OH&S MS) has become widespread over the past 20 years. However, there are few studies on the subject, they are generally methodologically weak and in many cases cannot be generalized. A formalized OH&S MS is a set of rules and connected elements of the general organization management system which guarantees accomplishment of the organization's objectives in the area of upgrading safety conditions of both employees and the environment. The need for research on voluntary management systems stems from the necessity to propagate appropriate solutions and their continuous development processes. This paper discusses an OH&S MS as a source of data and essential information on the process of developing a system. It examines the relationship between the degree to which the requirements of Standard No. PN-N-18001:2004 have been adapted and the demand for health and safety data and information.

OH&S management system data and information adaptation of system

1. INTRODUCTION

The idea of occupational health and safety (OH&S) remains on the sidelines of research on management [1]. Only 1% of research is associated with the issues of OH&S [2]. These statistical data are very unfavorable, especially in view of the high social and financial costs associated with OH&S and with accidents at work [3]. Economic analyses on inappropriate work conditions and their effects have been carried out for years. In the European Union (EU), the total cost of unsuitable work conditions is estimated at 2.8% of the gross domestic product [4]. On the other hand, mental health issues generate social costs of ~3–4%, mainly due to reduced productivity. Employees' health is a fundamental factor in a competitive environment [5].

The concept of an OH&S management system (OH&S MS) has become widespread over the

past 20 years. However, there are few studies, they are generally methodologically weak and in many cases they cannot be generalized [6]. The European strategy on safety and occupational health at work strongly emphasizes the need for promoting voluntary solutions undertaken on a voluntary basis by organizations rather than enforced by legal constraints. OH&S MSs are an example of voluntarily applied instruments defined in national and international standards [7]. Among research priorities in OH&S in EU states is research on developing the culture of preventive measures by implementing OH&S MSs, strengthening the role of corporate social responsibility and disseminating scientific discoveries and examples of good practices [8].

However, implementation of an OH&S MS in the general management of an organization requires the managers' support. They should allocate financial resources to activities which

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Correspondence and requests for offprints should be sent to Joanna Ejdys, ul. Piaskowa 33A, 18-106 Niewodnica Korycka, Poland. E-mail: <j.ejdys@pb.edu.pl>.

make up such a system, and they should be personally involved in them, showing a positive attitude and total commitment and interest [9, 10]. The international specification OHSAS 18001:1999/2007 [11] and ILO-OSH 2001 guidelines [12] are examples of such an approach. The International Labour Office (ILO) defines an OH&S MS as follows: “A set of interrelated or interacting elements to establish OH&S policy and objectives, and to achieve those objectives” (p. 19) [12]. A less formal OH&S MS can be understood as a set of policies, strategies, practices, procedures, roles and functions associated with safety [13].

OH&S means conditions and factors that affect, or could affect, the health and safety of employees or other workers, including temporary workers and contractor personnel, as well as visitors and any person present in the workplace. The state of OH&S on the level of an organization unit depends on fundamental elements stemming from the same definition of OH&S. Polish Standard No. PN-N-18001:2004 defines OH&S as “the state of work conditions and organization and employee behavior guaranteeing the required level of health and life protection from dangers existing in the work environment”¹ (p. 7) [14]. Therefore, these elements include

1. guaranteed appropriate work conditions and organization, an employer’s duty;
2. employees’ behavior, a human factor on the part of employees;
3. a required level of health and life protection in the work environment, defined by legal regulations [15].

Standard No. PN-N-18001:2004 is adapted to the requirements of ILO-OSH 2001 [12] and OHSAS 18001:1999/2007 [11]. Polish enterprises have been implementing OH&S MSs since 1999, i.e., the year of the first edition of Standard No. PN-N-18001. Currently, OH&S issues are regulated by the PN-N-18000 series of standards, which comprises four documents: PN-N-18001:2004 [14], PN-N-18002:2000 [16], PN-N-18004:2001 [17] and PN-N-18011:2006 [18].

¹ J. Ejdys’s translation.

A formalized OH&S MS is a set of rules and connected elements of the general organization management system which guarantees accomplishment of the organization’s objectives in improving safety conditions of both employees and the environment. The need for research on voluntary management systems stems from the necessity to propagate appropriate solutions and their continuous development. Whether voluntary management systems are successful depends to a large degree on human factors, in particular on the will to accept feedback on the system and to use it in the decision-making process. Regardless of the type of tools and instruments used in OH&S management there is always a need for their continuous improvement. Solutions that have worked well in one organization are not always applicable in another one. The improvement process is an indispensable element in reaching excellence, also in OH&S.

2. AIMS OF RESEARCH

According to the requirements of PN-N-18001:2004 [14] (or OHSAS 18001:1999/2007 [11]) the organization shall

- establish, implement and maintain a procedure(s) for the ongoing hazard identification, risk assessment, and determination of necessary controls;
- establish, implement and maintain a procedure(s) for identifying and accessing the legal and other OH&S requirements that are applicable to it;
- define and authorize the organization’s OH&S policy;
- establish, implement and maintain documented OH&S objectives, at relevant functions and levels within the organization;
- establish, implement and maintain a program(s) for achieving its objectives;
- appoint a member(s) of top management with specific responsibility for OH&S, irrespective of other responsibilities, and with defined roles and authority;
- identify training needs associated with its OH&S risks and its OH&S MS. It shall

provide training or take other action to meet these needs, evaluate the effectiveness of the training or action taken, and retain associated records;

- with regard to its OH&S hazards and OH&S MS, establish, implement and maintain a procedure(s) for internal and external communication;
- establish, implement and maintain the OH&S MS documentation;
- establish, implement and maintain a procedure(s): to identify the potential for emergency situations and to respond to such emergency situations;
- establish, implement and maintain a procedure(s) to record, investigate and analyze incidents;
- establish, implement and maintain a procedure(s) to monitor and measure OH&S performance on a regular basis;
- ensure that internal audits of the OH&S MS are conducted at planned;
- implement top management review of the organization's OH&S MS, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.

The study focused on OH&S MSs as a source of OH&S data and information reflecting the need to use the obtained data and information in decision-making processes. The relationship between the adaptation of the requirements of PN-N-18001:2004 [14] and the need to use OH&S data and information in decision-making processes was examined.

The following questions were formulated:

- How do the respondents assess the degree of adaptation of particular elements of the OH&S system according to the requirements of PN-N-18001:2004 in their organizations (i.e., the level of the maturity of the system)?
- How do respondents assess the need to use OH&S data and information generated by the existing OH&S MS? What kind of data and information is required in their organization?
- Does the level of maturity of the OH&S MS have a significant impact on the use of OH&S

data and information in the decision-making process?

The following hypothesis was formulated: the level of the maturity of an OH&S MS determines in a positive sense the use of OH&S data and information needed in decision-making processes.

3. METHODS

The choice of samples was deliberate. Participants were selected from individuals enrolled in postgraduate studies on OH&S management run by the Białystok University of Technology. One hundred and seven postgraduate students who professionally dealt with OH&S issues, who were employed in the field of OH&S services or who comprised its management participated in the study. This was so because only such individuals have a profound knowledge of OH&S issues in their organization and are familiar with the implementation of an OH&S MS.

A two-part questionnaire was used. Its first part comprised assessment of the degree of practical application in an organization of particular elements of the OH&S MS. On the basis of Standard No. PN-N-18001:2004 [14], 19 elements of the system were singled out. The respondents evaluated the practical application of those elements of the OH&S MS in their organization. The answers were rated on a 5-point Likert scale, in which 5 was the top grade (the element of the system exists, it is in operation, it is effective) and 1 the lowest grade (the element is missing). Further on in the analysis of the results, it was assumed that the declared conformity with the requirements of Standard No. PN-N-18001:2004 determined the level of maturity of the OH&S MS, measured with the total assessment of the 19 elements of the system.

The second part of the questionnaire listed issues associated with data and information essential to the development of an OH&S MS and used in a decision-making process. Thirteen categories of data and information were singled

out. The respondents assessed the need of a practical use of OH&S data and information generated by the OH&S MS. Again, a 5-point Likert scale was used.

Cronbach's α was used to assess the internal consistency reliability of the scales used in the questionnaire. The results conformed to Nunnally's suggestion that to be acceptable, Cronbach's α for a scale should be at least .7 [19]. The value of α for the two domain scales was .904; it did not increase when any of the items in the domains were deleted.

4. RESULTS

4.1. Assessment of OH&S MS Conformity

Assessment of the functioning of selected elements in an organization was made on the basis of the relative assessment coefficient (RAC), calculated according to the following equation:

$$RAC = \frac{\sum_{i=1}^n w_i}{w_{\max} \times N},$$

where w_i —value of assessment assigned by individual respondents on a 1–5 scale; w_{\max} —maximum value of assessment $w_{\max} = 5$; N —total number of respondents = 107.

The respondents assessed elements of the system in their organizations. They assigned values on a scale of 1–5, where 1—the element is not present in the organization and 5—the element is present in the organization. RAC was in the 0–1 range. Table 1 presents the values of RAC for individual elements of the OH&S MS.

According to the respondents, the following elements conformed best to the requirements of Standard No. PN-N-18001:2004 [14]:

- occupational risk management (identification of hazards and assessment of occupational risks);

TABLE 1. Relative Assessment Coefficient (RAC) for Elements of an Occupational Safety and Health Management System (OH&S MS)

Elements of OH&S MS	RAC
Occupational risk management (hazard identification, risk assessment)	.693
Clearly defined OH&S training procedures. Harmonization of training programmes with the needs of specific groups of employees	.679
Documentation system and control of OH&S documentation	.679
Supervision of activities associated with serious health and life hazards	.677
Prevention system, readiness and reaction to occupational accidents and serious emergencies	.664
Monitoring OH&S performance	.636
Top management's commitment to OH&S issues	.607
Internal OH&S communication system	.607
General objectives and detailed tasks concerning OH&S (clearly identified, measurable?)	.606
Purchase control within OH&S framework	.589
Plans for achieving OH&S objectives (tasks, timetables, responsibility and measures for their implementation)	.578
Representative of top management responsible for implementation and maintenance of OH&S MS	.564
External OH&S communication system	.553
Procedures of corrective actions and preventive actions stemming from monitoring process, audits and management reviews	.525
Internal OH&S MS audits	.512
OH&S policy (as a document)	.495
Control of subcontractors from the perspective of OH&S MS	.488
Reviews of OH&S MSs (conducted by representatives of top management)	.470
Employees' commitment to implementation and maintenance of OH&S MS	.450

- clearly identified training procedures in OH&S, training programs harmonized with the needs of specific groups of employees;
- documentation system and control of OH&S documentation;
- supervision of activities associated with serious health and life hazards;
- prevention system, readiness and reaction to occupational accidents and serious emergencies.

It is noteworthy that the elements of the system that the respondents assessed as best were at the same time elements required by the Polish labor law. Regardless of whether or not the organization has a formalized OH&S MS harmonized with Standard No. PN-N-18001:2004 [14], particular elements of the system must function in the organization. The respondents' assessed positively both procedures for training courses and an adjustment of the system of those courses to the needs of their beneficiaries. Taking into consideration the fact that system of training comprises all employees in organization, a positive evaluation of this element ought to have direct impact on the behavior of the employees with a higher level of awareness. An essential element of every training ought to be transfer of knowledge that not only provides an answer to the question "how to do it", but also to the question "what needs to be done and why"² (p. 8) [20].

The respondents gave the lowest marks to the functioning of the following elements in their organizations:

- internal audits of the OH&S MS;
- OH&S policy (as a document);
- control of subcontractors in view of the OH&S MS;
- OH&S MS reviews (carried out by representatives of top management);
- employee commitment to the processes of implementation and maintenance of the OH&S MS.

The first four elements constitute the requirements of Standard No. PN-N 18001:2004

[14]. If the OH&S MS is not implemented and certified, low assessment marks are justified by the employees' lack of knowledge caused by the disfunctioning of those elements in the organization. The conducted research confirmed that respondents gave the lowest assessment marks to the level of employees' commitment to implementing the OH&S MS. At the same time, the employees' limited commitment to OH&S issues was recognized. The results of the research showed that despite a very well assessed system of training adjusted to the employees' needs their involvement was assessed as unsatisfactory. This implies that the training organized in the organization did not go together with the employees' greater involvement, whereas it is the employees' involvement that is crucial for the success of an OH&S MS. An aware employee is one who not only has a certain level of knowledge, but who can also use this knowledge in everyday activities.

The maturity of the systems already in operation in organizations represented by the subjects was reflected by the sum of partial assessment marks for the 19 elements. Their range was 25–86, average 55.3. More than half of the respondents assessed the operating system to be over the level of 57. Figure 1 illustrates the distribution of characteristics, the system's maturity.

4.2. Need for OH&S Data and Information Generated by OH&S MS

Regardless of whether a correctly implemented OH&S MS will meet the requirements of Standard No. PN-N 18001:2004 [14] or whether it will be a system designed according to individual propositions, it should be a source of data, information and knowledge for the management and the employees of the organization. Subsequently, knowledge should be used in diverse decision-making processes. On the other hand, knowledge is needed to develop management instruments and techniques, which are being implemented. Moreover, the employees' awareness and the degree of their commitment to OH&S activities depend on the

² J. Ejdy's translation.

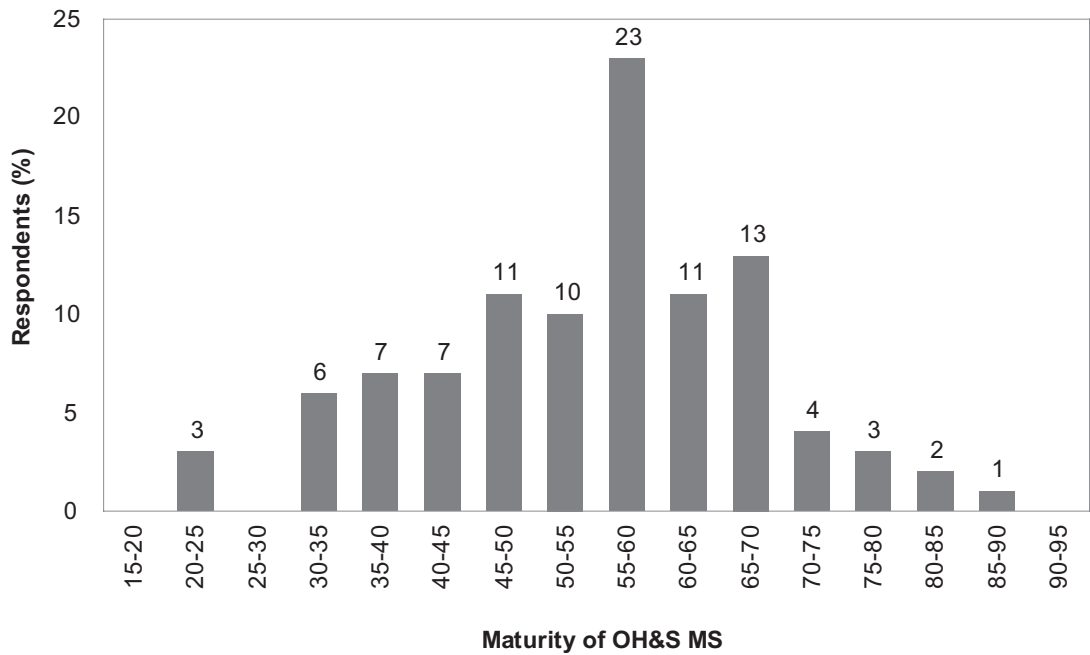


Figure 1. Maturity histogram of an occupational health and safety management system. *Notes.* Number of respondents = 107 • 5 • normal (χ ; 55.3364; 13.0947).

TABLE 2. Relative Demand Coefficient (RDC) for Occupational Safety and Health (OH&S) Data and Information

OH&S Data and Information	RDC
Existing hazards at the workplace and the results of occupational risk assessment. Results of monitoring work conditions	.725
Proper execution of activities and tasks at the workplace, maintaining OH&S principles	.720
Results (to human health and life) of exposure to risks generated in the work environment	.695
Occupational accidents which have taken place (kinds of accidents, number of injured workers, consequences, etc.)	.675
Causes of occupational accidents which have taken place	.645
Improvement and prevention activities in organizations in OH&S	.611
Consequences (to human health and life, financial consequences, no harmonization with the organization's current procedures, instructions, legal regulations	.609
Responsibility for OH&S issues (who is responsible for what, at all levels of the organization)	.602
Results of inspection of authorities: National Labour Inspectorate (PIP), Voivodeship Sanitary and Epidemiological Station (PSSE), State Sanitary Inspectorate (PIS)	.589
Degree of harmonization of work conditions in an organization with the terms of legal regulations (in OH&S). Results of assessment of conformity with OH&S regulations.	.540
Benefits associated with implementation of OH&S MS. Results of implemented activities aimed at upgrading OH&S conditions, e.g., decreased overall danger, decreased number of individuals at risk, decreased number of injured workers, decreased number of occupational accidents.	.471
Results of internal audits, management reviews and certification audits	.441
Costs incurred on activities focused on the development of OH&S (investments, training expenses, preventive actions)	.417

data and information available and distributed in the organization. However, the system of data and information on OH&S depends on the employees' demand for a certain type of knowledge necessary to make decisions.

The subjects used a 1–5 scale to evaluate the availability of recommended data and information significant in developing OH&S MS. Assessment of the declared demand for various categories data and information, as in the case

of the assessment of elements of the OH&S MS, was made on the basis of the relative availability coefficient. Table 2 presents the values of the calculated relative demand coefficient for data and information categories significant for the development of an OH&S MS.

The respondents most favorably assessed the demand for and availability of data and information on

- existing hazards at the workplace and the results of assessment of occupational risk, results of monitoring work conditions;
- proper execution of activities and tasks at the workplace, maintaining the principles of OH&S;
- results (important for human health and life) of exposure to work-related risks.

From the perspective of developing OH&S activities, the above scope of data and information indicates quite a high awareness of the subjects, who indicated a need for data and information with a direct relationship to individual employees. They wanted to know what impact the work environment had on their health. The respondents' declarations also showed their interest in preventive, precautionary

measures. The proper manner of carrying out actions and tasks at the workplace gives testimony to the level of their awareness and to the fact that OH&S conditions at the workplace to a large degree depend on the way they are implemented.

In the opinion of the respondents, there were least data and information on the following categories:

- costs incurred on activities focused on the development of OH&S;
- results of internal audits;
- benefits associated with implementation of OH&S MS.

These categories of data and information are significant in improving management. Their availability in an organization, however, does not have a direct impact on the work environment and the employees' health. That is one of the reasons why the availability of these categories of data and information was assessed as relatively low. Demand for those categories of data and information will impact the representatives of top management. It is representatives of top management that ought to be interested in the result generated by OH&S

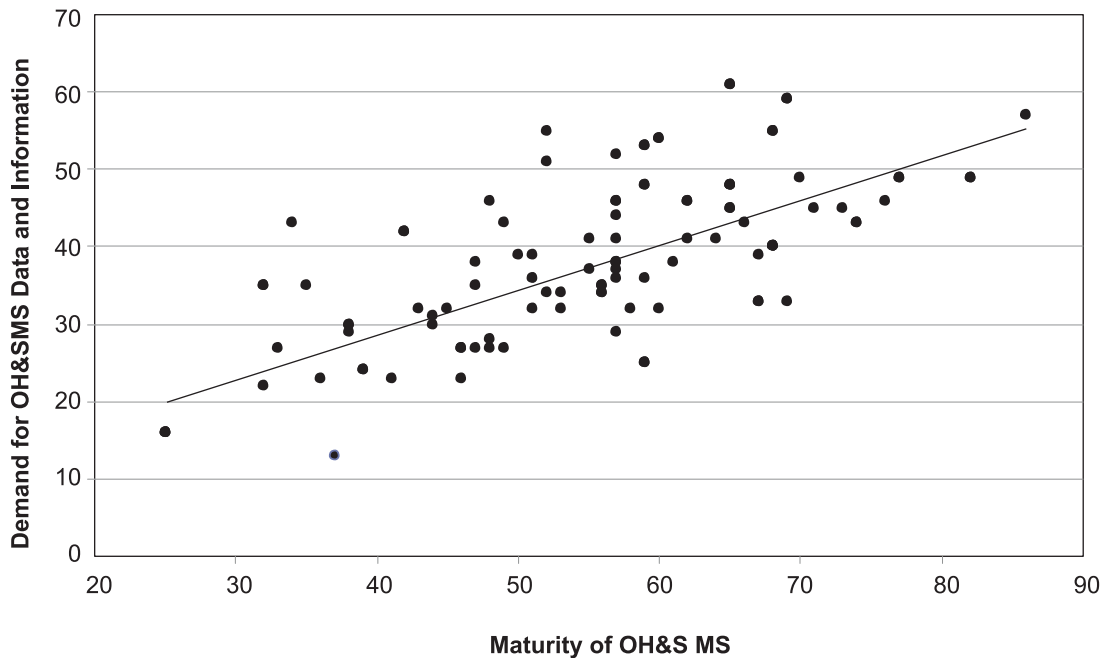


Figure 2. Correlation between maturity of an occupational health and safety (OH&S) management system and demand for OH&S data. Notes. $r = .6803$; demand = $8.2857 + 0.5478 \cdot \text{maturity}$.

MS at least for two reasons: (a) to provide evidence confirming that the previous decisions on implementing the system were correct and (b) to persuade other members of the organization to become more involved in issues related with OH&S. Since it was chiefly employees of the OH&S services that participated in the research, the demand for these categories was assessed as low.

4.3. Correlation Between Conformity of OH&S MS and Use of OH&S Data and Information

The research which was carried out made it possible to assess the relationship between the use of OH&S data and information and the maturity of the system operating in an organization. The results indicate a strong correlation between the availability (the resultant of the demand for knowledge in the organization) of data and information (measured with the sum of partial assessments for 13 categories of data and information) and the maturity of the OH&S MS (measured with the sum of the system's conformity for 19 elements). A two-dimensional distribution graph was used to visualize the correlation between the two variables (Figure 2).

5. DISCUSSION

Among the elements of an OH&S MS the following essentials were most highly assessed by the respondents:

- clearly identified training procedures in OH&S, harmonization of training programs with the needs of specific groups of employees;
- occupational risk management (identification of hazards and assessment of occupational risk);
- documentation system and control of OH&S documentation;
- supervision of activities associated with serious health and life hazards;
- prevention system, readiness and reaction to occupational accidents and serious emergencies.

It is disturbing that employees' commitment to OH&S issues was assessed least favorably. On the one hand this reflects on the respondents' awareness; on the other, this indicates a need for implementation of instruments increasing such participation. In the future, tools stimulating employees' initiative and engagement in OH&S issues should be further researched.

The respondents pointed out the need to use data and information on proper execution of activities, hazards at the workplace and the effect of exposure to work-related risks. The results of monitoring work conditions are evident in exposure to hazards in the workplace. Undoubtedly, this is a consequence of the current system of training in OH&S. At the same time, the respondents indicated poor availability of information on the results of inspections, the degree of harmonization of work conditions with legal regulations, costs generated by OH&S MSs, the results of internal audits, management reviews and certification audits and costs incurred on activities focused on developing OH&S. Within the context of occupational accidents, general data and information on accidents (e.g., the kind of accident and the number of injured people) which have taken place are more available in relation to information on the causes of occupational accidents.

Availability of data and information on OH&S is, on the one hand, the resultant of a properly functioning management system and, on the other hand, it ensues from the existing demand manifested by the employees. More aware employees will search for answers to a growing number of questions, they will seek data and information to use every day. An efficient OH&S MS ought to be constantly adjusted to more aware employees manifesting their demand for new data and information.

This research has shown a precise relation between the maturity of the management system and the availability of OH&S data and information. Greater maturity of a management system corresponds with greater availability of OH&S data and information, which is the resultant of a demand manifested in an organization. The results of the correlation

analysis proved that in companies with a high level of implementation of the PN-N-18000 series of standards [14, 16, 17, 18], it is necessary to have feedback on the state of OH&S MS and the obtained results.

Availability of OH&S data and information signifies undertaking appropriate, more rational and justified decisions. A properly designed OH&S information management system makes it possible to carry out preventive policy, avert occupational accidents and counteract hazards in the workplace.

6. CONCLUSIONS

Correlation between the level of maturity of an OH&S MS and the availability of OH&S data and information shows a positive effect of the systemic approach to the issue of OH&S management. The development of management systems operating in organizations should ensure increased availability of data and information on the degree to which work conditions are harmonized with relevant legal regulations, benefits of implementing OH&S MSs, results of internal audits, reviews of management and certification audits and costs incurred on activities aimed at improving OH&S MSs.

A data and information management system that comprises gathering, processing, using and distributing data and information directly impacts the perception of the organization's decisions on OH&S and guarantees an increase in employee awareness and their involvement. Moreover, one may assume that a system of data and information on OH&S reflects the employees' demand. Their greater awareness implies the necessity to obtain new data and information that are a source of knowledge ensuring answers not only to the question of how something should be done, but also why it should be done.

By means of an information management system, the process of developing an OH&S MS should aim at

- making employees aware of their role in improving an OH&S MS by involving them in the decision-making process;

- implementing an incentive system encouraging employees to undertake individual development practices;
- making employees aware of the relationship between organizational objectives defined in the OH&S policy and individual objectives and benefits;
- implementing a system of informing employees about the results generated by the OH&S MS, including economic benefits;
- developing processes of continuous employee formation along with verification of the use of acquired knowledge in improving the OH&S MS;
- stimulating innovation processes which will solve problems identified in formalized systems;
- shaping strong positive relations of the organization with its surrounding environment, which is the source of essential knowledge in upgrading management and technological processes and improving output;
- diverging from knowledge codification for the benefit of knowledge personalization.

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