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PSYCHOSOCIAL RISKS DIMENSION IN DECISION SUPPORT SYSTEM

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Abstract: *The decision-making process represents one of the most important dimensions of management in organizations, affecting the efficiency and the adaptability capacity in the organizational environment. Therefore, knowledge of factors influencing the decision-making process is essential. In this context, an IT decision support system was designed with mission to facilitate the activity of decision-makers (managerial staff in an organization), located at different management levels (from the supervision of technological processes to top management), in the sense of making decisions better (more effective) and documented. One of the main elements of this system, and of the whole decision-making process, was considered the psychosocial environment and its risk factors have been investigated.*
Key words: *occupational risks, psychosocial risks, decision, organizational environment, support system.*

1. INTRODUCTION

The development of IT related to the first expert systems was also focused on decision support systems [1], with the aim of ensuring occupational safety. There are no universally accepted delineations of these support systems, as "any kind of support system that provides more than a decision made by rolling a dice is important and constitutes a decision support system" [2].

Studies on decision support systems have been undertaken for over 45 years with such systems proving useful in supporting semi-structured and unstructured problems [3].

Since 1976, Mintzberg et al. [4] stated the process of decision making as conceived in terms of three major factors: problem identification, development of alternative solutions and selection among the alternatives.
Classical expert systems were primarily directed at displacing human decision making. In keeping with current aspirations for decision support systems, the use of IT systems potentially offers broader scope for decision support that allows flexible human–computer engagement.

A decision support system based on programming is an IT system whose mission is to facilitate the activity of decision-makers (managerial staff in an organization), located at different management levels (from the supervision of technological processes to top management), in the sense of making decisions better (more effective) and documented [5]. Such systems provide the decision-maker (related to occupational risks) with sufficient support for that decision to minimize or eliminate certain risks that have been identified.

These systems are usually designed in multi-layer architectures, depending on the support needs of decision makers. Thus, it is possible that the decision maker has some information about the problem - in this case (and usually) the basic layer of the system [6] is consisting of a tutorial/information system.

Generally, decisions regarding occupational risk are made following assessments of the area for which the decision is made [7, 8]. Therefore, on an intermediate layer, a component is demanded (possibly an expert system [9, 10] of occupational risk assessment).

A decision cannot be adopted without a clear referential (hence the need for decision support systems), as well as a clearly defined target as the recipient of this decision. The upper layer of

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the system is usually a procedural layer [11], including procedures for assessing occupational risk and preventing its manifestations), also involving control functions [12]. Among the procedures worth mentioning in this case are those related to ROP (Return on Prevention – the (financial) result of prevention).

2. METHODS

The SmartRisk decision support system was created within a partnership project for the transfer of knowledge and the development of research related to the assessment and prevention of occupational risks that can lead to disasters. The starting point was to consider the decision support system as having as its main objective assisting the decision maker in different phases of the decision process. The complex issue of making some decisions requires knowledge of the components of the decision-making process and the factors that influence the quality of decisions.

The quality of decisions is influenced by a series of factors generated by the qualities of the decision-maker and the environment in which they carry out their activity. The adoption of viable decisions requires the organization and systematization of the activity of the decision-makers, so that the preparatory works for their materialization take place in a logical sequence.

The SmartRisk decision support system was designed to assist in decision-making regarding major accidents, comparable to disasters. The decision support system supports the user by providing data and information, directly or by accessing reliable sources, some belonging to official bodies; logical structuring of information to guide decisions; establishing links with tools that allow complementary analyses or simulations to serve information and decision-making.

The system is based on a set of stages of the decision-making process that can be applied, in principle, to any type of activity, keeping a common structure:

- Identification of hazards/risk factors;
- Risk assessment;
- Establishing prevention and protection measures.

The system starts from a basic sequence which is then customized and developed into specific logigrams. They present the steps to follow in the decision-making process, with a particularity for biological, chemical and psychosocial risk factors. SmartRisk logigrams are interactive and refer to databases useful to the decision maker in making the final decision.

The SmartRisk System can be used either as a "road map" in which the beneficiary goes through the logigrams in a non-computerized form, or specialized software can be used to support the decision.

SmartRisk System is structured in three directions that refer to: Biological risks; Chemical risks; Psychosocial risks. In addition to these three types of risk, the system can be used, with adaptations, for other risks relevant to disasters.

The SmartRisk System methodology goes through the same steps for all risks: identifying hazards, assessing risks and indicating the types of prevention and protection measures.

3. RESULTS: PSYCHOSOCIAL RISKS WITHIN SMARTRISK SYSTEM

The risks related to the human factor and the environment created by it in the organization, resulting in the psychosocial dimension, were taken into account starting from the idea that the human operator being the dynamic component of the work system, it goes without saying that his errors will not could be described analogously to technological errors - with the possible exception of some types of algorithmic behaviors, with constantly increased performance (for example, hyper-trained skills).

Moreover, in cases where the interaction of the human operator with the other components of the work system is mostly based on cognitive or mental functions and less on externalized reactions in action, the use of the probabilistic description of "human error" as the sole cause of an accident work does not make sense, because the "component" that "fell" represents an abstract construct, on which inferences are drawn rather than being directly observed. It is obvious that human reliability plays an essential role in every phase of the system life cycle, even if the effects of action errors are not immediately

visible in many cases. Consequently, the overall understanding of the role of the human operator and his reliability is imposed as a sine qua non condition in the context of the work system. "Human reliability is not the exclusive expression of the intrinsic reliability of man" [13], but, in order to reduce the incidence of errors in the activity, one can speak of a human - work load reliability, depending on the quality of the interaction between the capacities / competences the human operator and the characteristics of the task, as well as the conditions of the work environment. Human reliability depends not only on the individual capabilities and the general reliability of the human operator, but also on the professional environment in which he operates, with emphasis in recent years on the psychosocial dimension.

The human being is a complex bio-psycho-social entity; therefore, regardless of the nature and path of action of an external factor, be it harmful, aggressive or beneficial, the human individual, his organism reacts as a unitary whole on all its manifestation planes: physical, physiological, neuroendocrine, psycho-emotional, behavioral, social. In this context, external, professional or existential factors, to the extent that they come into contact with man and interact with him causing (in all situations) complex reactions, with a great psychological involvement, have been called psychosocial factors (not in relation to the nature original, but with their transformation and becoming in contact with the man on whom they act).

In other words, psychosocial professional factors, as psychological risk factors, represent the result of an interaction between professional factors (work load - through its content, nature and characteristics, the work environment, the conditions for organizing the activity and setting up the workplace, interpersonal relationships, managerial practices, conditions of employment, promotion and job retention, etc.) and individual factors (abilities, abilities, needs, aspirations, level of education and culture, etc.). The human capacities and limits that determine the outcome of the interaction are based on the biological and psychological characteristics of the human being in general (case in which the professional factors concerned have potentially harmful or beneficial effects for all individuals), on the individual characteristics of the respective person and on the social context (case in which the result of the interaction is different from individual to individual).

The Risk Observatory Report defined the psychosocial risks as "those aspects of the design, organization and management of work, of the social and environmental context of work, which can lead to psychological, social or physical injuries" [14]. Regarding the legislative foundation, it was specified that the international, European and national legislation, there are: regulations in the field of safety and health at work regarding the concept of occupational risk in general; legislative and non-legislative acts with direct reference to the concepts of psychosocial risk, stress, harassment and violence.

The decision-making process, as one of the most important dimensions of management in organizations, affecting the success or failure of the entity, is influenced by a highly uncertain environment. Therefore, knowledge of factors influencing the decision-making process is essential [15].

Both decision-making competency and decision environment management are presumed to involve self-regulatory mechanisms and risk factors as well connected to decision processes by influencing performance in relation to the work environment conditions [16].

Psychosocial risks and resulting consequences for mental and physical health are among the most challenging issues in occupational safety and health (OSH). Besides their detrimental effect on individual health, psychosocial risks can also negatively impact the decision-making process in organizations, their efficiency as well as national economies [17].

In relation to psychosocial risks identification, the SmartRisk logigrams considered:

- Indicators indicators related to the operation of the enterprise; indicators related to worker safety and health;
- Individual indicators, with emphasis on the biological indicators of some effects

produced by various occupational risks/harms contained in the Order of the Minister of Health and Family no. 803/2001 regarding the approval of relevant exposure and/or biological effect indicators for establishing the body's specific response to occupational disease risk factors, indicators valid for all types of activities, jobs and working conditions.

Thus, reference was made to:

a) external exposure indicators: the presence of biological occupational noxes, of noxes with the Fp indicator and the measurable and quantifiable presence of physical and chemical occupational noxes in the workplace area.
b) internal exposure indicators: the measurable and quantifiable presence of an external agent or its metabolite in biological environments, without altering the structure and/or function of organs, devices or the body as a whole.
c) indicators of biological effect: the measurable and quantifiable presence of changes in the structure, function of an organ, device or the body, proven by the deviation from normal of some biochemical, functional, immunological, genetic or systemic constants, consequence of exposure to a agent from the work environment.
d) response of the body: any reversible or irreversible change in the structure or function of an organ, device or the body, objectified by symptoms, syndrome, pathological entity for which there is scientific evidence of a significant positive association with exposure to an agent in the environment for work.
e) specific response of the body: the complex of clinical and para-clinical changes that, under the conditions of exposure to risk factors in the work environment, characterize occupational disease and/or overwork.

Indicators or warning signals at the organizational level, which were considered within the procedures included in the psychosocial risk logigrams, were, for example: alerts from the occupational medicine doctor; recurring complaints from employee representatives regarding the general work environment (organization, work methods, physical and psychosocial work environment, etc.), accusations regarding the state of health; degradation of communication between colleagues; a tense social climate (strikes, violence, etc.); decrease in activity performance.

Regarding the specific individual indicators or the signs that progressively reflect severe forms of stress - with phenomena of disturbance of the individual state, among those that could affect the decision-making process were considered: negative states of the individual or group disposition - persistent or recurrent or emotional states reflecting increasing anxiety, depression and irritability; functional change in one or more body systems indicating deviant activity in relation to normal limits (for example, increased heart rate); important behavioral changes indicating negative ways of coping - escape behaviors in relation to unpleasant professional experiences (for example, increased rate of absenteeism without explainable causes); biochemical and/or physiological changes with a slow reversibility, of a non-specific and possibly pathogenic nature (recurrent digestive disorders, arterial hypertension); aberrant behaviors to the detriment of health, interpersonal relationships, professional goals (for example, excessive alcohol consumption); morphological changes indicating somatic or mental diseases (myocardial infarction, ulcer, neuroses, etc.).

4. CONCLUSIONS

It is necessary to characterize the situation by searching for and finding the appropriate indicators for the concrete situation analyzed, which can confirm the presence of psychosocial risks. In the situation where these risks have an assumed collective origin, it is necessary to initiate a preventive measure. Regardless of the data collection method, information must be obtained about employees' perceptions of their working conditions and the levels of awareness and perception of psychosocial risk factors, stress, health and job satisfaction. The list of potentially stressful working conditions, the objective alarm signals and the effects of stress

on the individual provide the starting points for the decision regarding the information to be collected.

Objective aspects, such as occupational illness, staff mobility, absenteeism or performance problems, can also be analyzed to establish the presence and dimensions of work-related stress. In any case, these aspects are, at best, only crude indicators of workplace stress. Data from discussions, studies and other sources must be aggregated and analyzed to answer questions about the work and organizational conditions likely to be responsible – for example, are there psychosocial risk factors that lead to increased levels of stress across the board? organization or is it a situation specific to a single department or certain jobs?

A working group made up of both prevention actors from the company and experts from outside the company must participate in the evaluation process, depending on the complexity of the investigated work situation. The working group will choose from the multitude of tools, techniques and indicators available, those relevant to the situation in question. Next, after the identification of the risk factors and their effects, we proceed to the adoption of preventive/corrective action programs.

These programs must be included in the Prevention and Protection Plan drawn up by the employer, according to legal obligations, and contain two large groups of actions, considering that states of stress, imbalance, and health disorders result from the deficient interaction of an accumulation of factors - professional, extra-professional and individual.

As a priority, the actions must aim at two directions: avoiding overload and stress situations by eliminating or reducing professional risk factors; helping and supporting staff to deal with risk factors and situations that cannot be eliminated.

5. REFERENCES

[1] Coiera E., Westbrook J., Wyatt J., *The safety and quality of decision support systems,* http://www.ncbi.nlm.nih.gov/ pubmed/17051, 290, 2014.

[2] Truscott P.A, *How to manage decisions using IT tools*, in Proceedings of the XXI IT Canberra Conference, pp. 45-52, 2015.

[3] Beynon M., Rasmequan S., Russ S., *A new paradigm for computer-based decision support,* Decision Support System, Elsevier, 33 (2), pp. 127-142, 2002.

[4] Mintzberg H., Raisinghani D., Theoret A.,T*he structure of "unstructured" decision processes*, Administrative Science Quarterly, 1976.

[5] Filip, F.G., *Towards more humanized real-time DSS*. In L.M. Camarinha-Matos, H. Afsarmanesh (Eds.), Balanced Automation Systems: Architectures and Design Methods. Chapman & Hall, London, pp. 230-240, 1995.

[6] Rodd D., Lavine Q.A., *Designing support systems*, McManus, Sidney, 2015.

[7] Tseng M.H., Wu H.C.A., *Cloud medication safety support system using QR code and Web services for elderly outpatients*, http://www.ncbi.nlm.nih.gov/pubmed/24561 883., 2013.

[8] Humphrey, P., *Introduction*. In P. Humphery, L. Bannon, A. Mc. Cosh, P. Migliarese, J. Ch. Pomerol (Eds.), *Implementing Systems for Supporting Management Decisions: Concepts, Methods and Experiences*. Chapman & Hall, London, pp. VII-X, 1996.

[9] Kusiak, A., *Intelligent Management Systems*. Prentice Hall, Englewood, N.J., 1990.

[10] Moore, J.H., Chang, M.G. *Design of decision support systems*. Data Base, 12(1,2), pp. 8-14, 1980.

[11] Loebecke, C., Bui, T.X., *Designing and implementary DSS with systems dynamics: lessons from modeling a global system of mobile communication (GSM) market.* In P. Humphrey, L. Bannon, A. Mc. Cosh, P. Migliarese, J.Ch. Pomerol (Eds.), I*mplementing Systems for Supporting Management Decisions: Concepts, Methods and Experiences*. Chapman & Hall, London, pp. 270-287, 1996.

[12] Neubert, G., Rezg N., Campagne, J.P., *Supervisory control: towards a proactive attitude*. In Z. Binder, B.E. Hirsch, L.M. Aguillera (Eds.), *Proceedings, Conf. on*

Management and Control of Production and Logistics - MCPL'97. Campinas, Brasil, August 31- Sept. 2, pp. 400-405, 1997.
[13] Iosif Gh., *Psihologia fiabilităţii umane,* Editura Victor, București, pp. 149-190, 2007.
[14] European Agency for Safety and Health at Work (EU-OSHA), *Expert forecast on emerging psychosocial risks related to occupational safety and health.* European Risk Observatory Report. Office for Official Publications of the European Communities, Luxembourg, 2007.
[15] Kozioł-Nadolna K., Beyer, K., *Determinants of the decision-making process in organizations***,** Procedia Computer Science 192(6), pp. 2375-2384, 2021.
[16] Ceschi, A., Demerouti, E., Sartori, R., Joshua, W., *Decision-Making Processes in the Workplace: How Exhaustion, Lack of Resources and Job Demands Impair Them and Affect Performance*, Front Psychol., 8: 313, 2017.
[17] European Agency for Safety and Health at Work (EU-OSHA), *Psychosocial risks and workers health*, 2022, Available at: https://oshwiki.osha.europa.eu/en/themes/psychosocial-risks-and-workers-health

Dimensiunea riscurilor psihosociale în sistemul suport de decizie

Procesul decizional reprezintă una dintre cele mai importante dimensiuni ale managementului în organizații, afectând eficiența și capacitatea de adaptabilitate a instituției în mediul organizațional. Prin urmare, cunoașterea factorilor care influențează procesul de luare a deciziilor este esențială. În acest context, a fost conceput un sistem informatic de suport al deciziilor cu scopul de a facilita activitatea factorilor de decizie, localizați la diferite niveluri de management (de la supravegherea proceselor tehnologice până la managementul de vârf), în sensul luării deciziilor mai corect (mai eficient) și mai documentat. Unul dintre elementele principale ale acestui sistem, și al întregului proces de luare a deciziilor, a fost considerat mediul organizațional psihosocial, astfel fiind investigați factorii de risc derivați din acesta.

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