

A KNOWLEDGE MANAGEMENT APPROACH FOR RISK MANAGEMENT

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Abstract:

The complexity thinking of modern organizations management moves from the classical systemic theory to the business process management approach. This has suggested that relationships between subsystems are more important than the parts themselves and furthermore, minimum specifications yield more creativity than detailed plans. Treating organisations as complex adaptive systems (evolving in a dynamic environment) allows a more productive management style that has been developed also, for the health care organizations. In addition, the preoccupations on risk management have been considered as the core of high quality health care services (as system's out-put) together with the continuous improvement of the services quality. The goals of risk management are prevention, analysis, decision making, settlement, mitigation, and process improvement. In this context, in the first part of the paper is presented an overview of the risk management approach using conceptual and/or terminological maps that are preliminary steps for a risk management knowledge application. This approach could be useful for the risk mitigation initiatives. In the second part of the paper, through a case study (ambulance and emergency intervention service/process), there are shown the practical implications and results of the risk assessment using the knowledge management proposed approach (11 risks with high values of number risk priority indicator, high probability of occurrence and gravity, were identified together with 9 important causes that determine those risks development). Findings of the practical research done have generated an improved strategy and reaction plan for the ambulance unit, in order to better monitor and control the identified risks.

Keywords: knowledge, risk, management, knowledge map, health care

1. INTRODUCTION

Health, Safety and Environment Management (HSE) implementation need to take into consideration the ISO 14001: 2007 and the processes (and related activities) related to the risk management program in accordance with the ISO 31000: 2009 standard. This has to define and characterize (mapping) all organization's processes together with their related results (it is mandatory to understand the relations between processes and their activities, too). The organizational processes mapping will identify the potential sources of hazard. "Moreover, in order to achieve enough knowledge to underlie adequate action of HSE process, data must be collected from the activities and operations, about its *Processes* (inputs and outputs), its *People* who work there, and generally about the *Organization* itself" (Haddad et al., 2012).

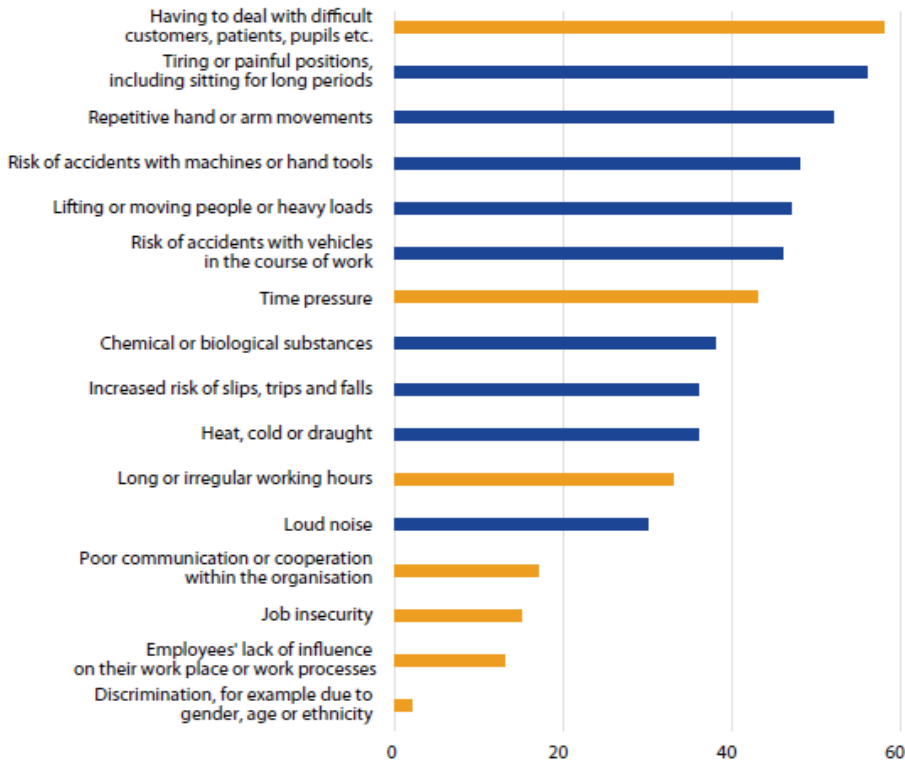
In this context, occupational health and safety (OHS) approach has an important role, because it concern with minimizing loss by aiding in the preservation and protection of both human and other physical assets in the workplace. OHS discipline primarily involves monitoring the workplace and advising employers and/or managers on the best ways to prevent and minimize losses. From the practical perspective, OHS address moral and economic issues (by considering the legal framework define by specific laws, norms and standards) (Friend & Kohn, 2014).

Occupational risk assessment (analysis and evaluation) approaches are linked with the general concerns of work systems safety assurances and organizations environment policies development and implementation. Nowadays, organization social/sustainable responsibility is an important subject (Erickson, 2003); (Friend & Kohn, 2014). There have been recognized that workplace safety and health is a mandatory action that have to be taken into practice for the benefit of both workers (employees of all categories) and the business itself (for managers and different stakeholders). Managers of all levels, specialists and researches are concern of the problems related to the working systems impact on the environment and also, on life quality. They support actions or initiatives that aim to diminish or eliminate the work accidents and occupational diseases, by using different methodologies of analyzing different risk categories impact or influence in practice (risk sources, the way of development, evolution, impact, effects and measure of diminishing or elimination) (Thébaud-Mony et al., 2012).

The importance of the problem has been recognized each year by at the European Union level. The EU Strategic Framework on Health and Safety at Work 2014-2020: Adapting to new challenges (EU-OSHA, 2015) has confirmed (by the Council and the Commission) the following needs to be accomplished in order to better face the new challenges in the field: to improve the implementation of the existing OHS legislation; to prevent existing, new and emerging risks to health and safety at work, and to address the challenges posed by an ageing workforce and longer working careers. In addition, projects' actions taken by companies and institutions together with the social partners are of great importance and success.

Furthermore, the Second European Survey of Enterprises on New and Emerging Risks (ESENER-2, 2015) and developed in the context of the European Framework Directive 89/391/EEC), has underlined important findings of occupational health and safety practice. "Regarding the ageing society, 21 % of establishments in the EU-28 indicate that employees aged over 55 accounts for more than a quarter of their workforce. By country, the highest proportions are found in Sweden (36 %), Latvia (32 %) and Estonia (30 %) as opposed to Malta (9 %), Luxembourg (9 %) and Greece (10 %). 13 % of establishments in the EU-28 report that they have employees working from home on a regular basis, with the highest proportions in the Netherlands (26 %) and Denmark (24 %) as opposed to Italy (4 %) and Cyprus (5 %). 6 % of establishments in the EU-28 report having employees who have difficulties understanding the language spoken at the premises. This figure ranges from 16 % in Luxembourg and Malta and 15 % in Sweden to the lowest proportions (around 2 % of establishments) in Slovakia, Romania and Poland, among others. Outside the EU-28, the highest proportions are reported in Iceland (26 %) and Norway (17 %). The most frequently identified risk factors deal with difficult customers, pupils or patients (58 % of establishments in the EU-28), followed by tiring or painful positions (56 %) and repetitive hand or arm movements (52 %)". More details can be seen in Figure 1 (the psychological risk factors are represented in orange).

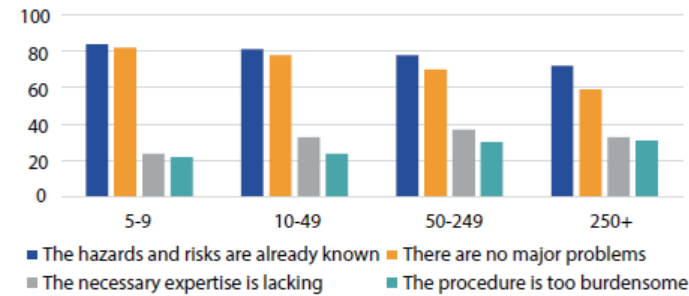
Figure 1: Risk factors presented by the ESENER-2



Source: ESENER-2, 2015

In addition, the results of the ESENER-2 research underlined that psychosocial risk factors are of high concern because they are “perceived as more challenging than other risks; almost one in five of those establishments reporting dealing with difficult customers or experiencing time pressure indicate that they lack information or adequate tools to deal with the risk effectively”. The ESENER-2 survey’s results on risk assessment (with respect to the European approach to OSH, as specified in the EU Framework Directive 89/391/EEC on Safety and Health at Work) indicates that “76 % of establishments in the EU-28 carry out risk assessments regularly. As expected, there is a positive correlation with establishment size, whereas by country the values range from 94 % of establishments in Italy and Slovenia, down to 37 % in Luxembourg”. Regular risk assessments are seen as useful ways of managing safety and health (90 %), but there are significant differences when it comes to the proportion of establishments where risk assessments are conducted mainly by internal staff. “The country ranking changes significantly, being topped by Denmark (76 % of establishments), the United Kingdom (68 %) and Sweden (66 %). The lowest proportions are found in Slovenia (7 %), Croatia (9 %) and Spain (11 %)”.

Figure 2: Reasons why workplace risk assessments are not carried out regularly, by establishment size (% establishments, EU-28)



Source: ESENER-2, 2015

According to the representations in Figure 2, “looking at those establishments that do not carry out regular risk assessments, the main reasons given for not doing so are that the risk and hazards are already known (83 % of establishments) and that there are no major problems (80 %). The major reasons for addressing safety and health into organizations are: fulfilling the legal obligations (respect to the standards, norms and laws); meeting expectations from employees or their representatives and stakeholders; avoiding fines from the labour inspection institutions or organizations; maintaining organizations’ reputation (imagine on the market and in the community); respect to the general relation that OHS have a positive impact on work productivity and performance.

The ESENER-2 study has pointed out the actual problems that organizations are facing with in the field of occupational risk management, but also, it has characterized tendencies in the field as: the importance (as a success factor in sustainable development) of continuous risk assessment and monitor. This is the topics of the present article that will debate the risk management problem in the case of medical organizations operating in the health care system in Romania. The preoccupations on risk management have been considered as the core of high quality health care services (as system’s out-put) together with the continuous improvement of the services quality. Generally, the goals of risk management are: the prevention, analysis, decision making, settlement, mitigation, and process improvement.

In this context, in the first part of the paper is presented an overview of the risk management approach using conceptual and/or terminological maps that are preliminary steps for a risk management knowledge application. This approach could be useful for the risk mitigation initiatives. In the second part of the paper, through a case study (ambulance and emergency intervention service/process), there are shown the practical implications and results of the risk assessment using the knowledge management proposed approach (11 risks with high values of number risk priority indicator, high probability of occurrence and gravity, were identified together with 9 important causes that determine those risks development). Finally, some conclusions and remarks on future researches will be made.

2. METHODOLOGICAL ASPECTS

In the occupational safety approaches one of the most difficult goals is to prioritize actions towards risk prevention and mitigation; several methodologies can support this process. Choosing one method depends on the cost – efficiency analysis and also, the difficulties that are predicted in their implementation. Risk analysis should used systematic approach that could deliver good results on technical and scientific basis (Haddad et al, 2008). This problem could be better solved using knowledge management approaches (methods and tools) follow the research results of (Draghici et al., 2011; Draghici & Draghici, 2013; Iva;cu et al., 2014; Draghici et al., 2014).

Table 1: Description of the risk management methods combine with knowledge management activities

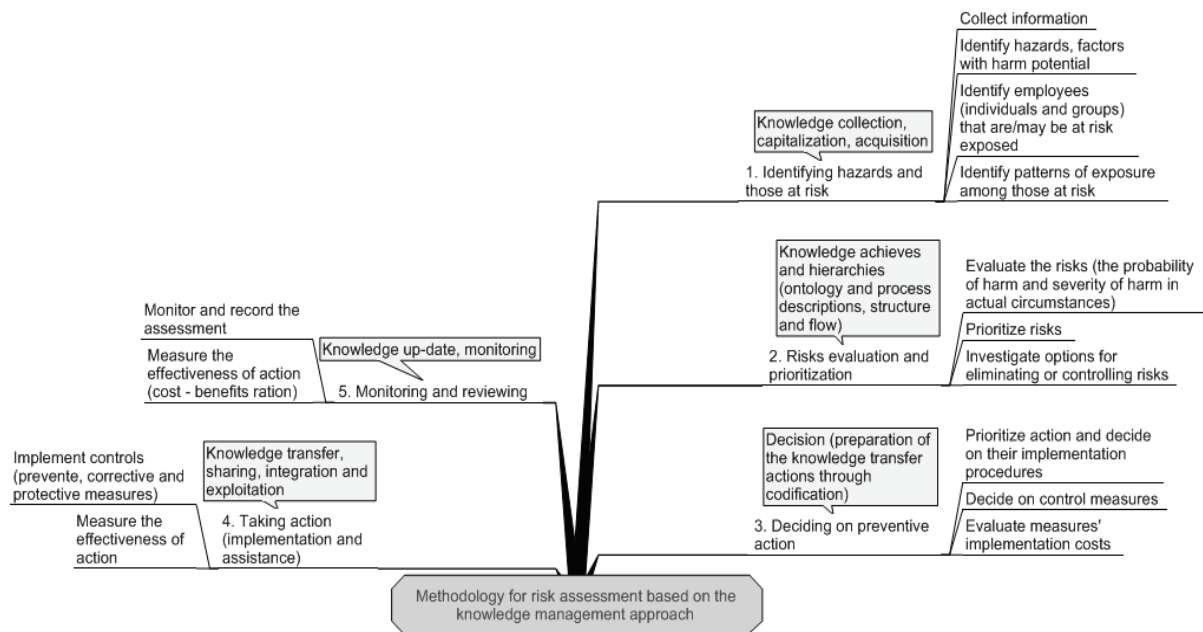
Assessment steps	Risk assessment actions	Knowledge management actions
1	Identifying hazards and those at risk	Knowledge capitalization, acquisition, collection
2	Evaluating and prioritising risks	Knowledge achieves and hierarchies (ontology and process descriptions) (Draghici & Draghici, 2013)
3	Deciding on preventive action	Decision (preparation of the knowledge transfer actions through codification)
4	Taking action	Knowledge transfer, sharing, integration and exploitation
5	Monitoring and reviewing	Knowledge up-date, monitoring

Source: Authors own development after the <https://osha.europa.eu/en/topics/riskassessment>

The proposed methodology was developed from the traditional risk assessment steps described in European Guidance and the associated knowledge management activities. Details about the proposed approach are given in Table 1 (to be understand together with the iterations between steps and in the context of the continuous improvement of the occupational health and safety conditions) and Figure 3. The assessment has to be adapted to the organizational system nature and process (taking into consideration the specific technological and administrative processes; the type of process, as repeated operations, developing/changing processes, work on demand etc.), the task performed by

the employees (e.g. repetitive, occasional or high risk) and the technical complexity of the work processes.

Figure 3: The knowledge management approach for the risk assessment (knowledge map)



Source: Authors development

The proposed knowledge management implications in order to support the risk assessment there have been designed and develop a web platform, for the risk assessment and allow resumption at any time from any point. With this platform, managers of different levels can better define their strategies, policies and tactics in the occupational health and safety field. The OnRisk platform consists of several pages created in HTML and PHP scripts, based on the predefined risk ontology. WampServer 2.1 was used in order to run the application, which is basically, a mini-server that provides users access to the web page. WampServer is a complex tool that runs on Windows operating systems.

There have been demonstrated through several case studies that the OnRisk platform could generate benefit for any organization, been a tool to identify opportunities and risks and optimally treating the identified risks by not omitting them. These support the implementation of the occupational health and safety initiatives and projects, too. Major imperatives of this concept are identifying risks and understanding their evolution, risk treating and not delaying their management, ongoing communication and lack of transparency.

3. DISCUSSIONS BASED ON A CASE STUDY - THE RISK ANALYSIS

In this part of the paper, through the case of an ambulance and emergency intervention service unit, there are shown the practical implications and results of the risk assessment using the knowledge management proposed approach (11 risks with high values of number risk priority indicator, high probability of occurrence and gravity, were identified together with 9 important causes that determine those risks development). The risk assessment process takes into consideration the processes and activities specificity in the medical field in generally, and for the ambulance and emergency intervention service, in particular.

Medical risk management has to consider four categories or potential risk sources together with their management activities: economical risk management, juridical risk management, patient risk management and the medical staff risk management. From preliminary risk this analysis there have been used the FMEA method and the results gained were compare with the risk results delivered by the OnRisk platform (systematic and integrated evaluation).

3.1. Management risk assessment using the FMEA method

The Failure Modes and Effects Analysis (FMEA) is the risk assessment scheme published by the MIL STD 1629 (UNITED STATES, 2000) and used spreadsheets to decompose the risk in its failure modes, causes and consequences. "FMEA is a systematic, proactive method of evaluating a process. An FMEA identifies the opportunities for failure ("failure modes"), in each step of the process. Each failure mode gets a numeric score that quantifies (a) likelihood that the failure will occur, (b) likelihood that the failure will *not be* detected, and (c) the amount of harm or damage the failure mode may cause to a person or to equipment. The product of these three scores is the Risk Priority Number (RPN) for that failure mode. The sum of the RPNs for the failure modes is the overall RPN for the process. As an organization works to improve a process, it can anticipate and compare the effects of proposed changes by calculating hypothetical RPNs of different scenarios. Just remember that the RPN is a measure for comparison within one process only; it is not a measure for comparing risk between processes or organizations. RPN, is a numeric assessment of risk assigned to a process, or steps in a process, as part of Failure Modes and Effects Analysis (FMEA), in which a team assigns each failure mode numeric values that quantify likelihood of occurrence, likelihood of detection, and severity of impact" (according to the method applications by Institute for Healthcare Improvement, 2015).

Table 2: Criteria used in the risk assessment (the case of an ambulance and emergency intervention service unit)

Severity	Criteria used for assessing	
	The problem occurrence probability	The problem detection probability
10 = The patient's life is endangered	10 = The problem permanent arises	10 = The problem cannot be detected
9 = The legislation is not applied	9 = The problem arises on 1/10 cases	9 = No existing measures for the problem detection
8 = Major additional medical problems occur	8 = The problem often arises on 1/50 cases	8 = The detection problem is done by the client/patient through him/her complaints/dissatisfaction
7 = Minor additional medical problems occur	7 = The problem often arises on 1/100 cases	7 = The problem detection is done by random checks
6 = Medical procedure with no positive effect	6 = The problem often arises on 1/500 cases	6 = The problem detection is done by internal audit
5 = Failure in applying organizations' own/internal rules, norms	5 = The problem occurs occasionally, on 1/1000 cases	5 = The detection problem is done by planned checking actions
4 = Medical procedure with minimal positive effect; problems in communication with the patient	4 = The problem occurs occasionally, on 1/5000 cases	4 = The detection problem is done at a later stage
3 = Medical procedure with minimal positive effect	3 = The problem is rare, it arises on 1/20000 cases	3 = The detection problem is done using a control or checklist
2 = Slightly disgruntled patient	2 = The problem occurs on 1/100000 cases	2 = The detection problem is almost certain
1 = No effect on patient	1 = The problem never appears	1 = The problem is certainly detected

Source: Authors own development

In the considered case study for the ambulance and emergency intervention service unit, there have been established the criteria used (Table 2). After the development of steps one and two of the risk methodology (Table 1), there have been identified 183 risks have a RPN \leq 160 and 11 risks have a RPN \geq 160 (from the total of 194 identified risks). For the risks categories with RPN \geq 160 were identified 9 cases, as presented in Table 3.

FMEA conclusions on risks identification has determined decisions on implementing measures in order to improve work conditions and the medical, healthcare services 'quality. At the ambulance and emergency intervention service unit has been developed a strategy and a response plan on controlling

the high impact risks identified, and at the end of 2015 there will be carried out an evaluation of these measures effectiveness by reconsidering the frequency and measures of problems detection.

Table 3: Identified causes for risks with RPN \geq 160

Causes	RPN	The problem	Effect
Insufficient medical knowledge	280	Inadequate transportation of the patient to the healthcare unit	Medical, healthcare service delivered improperly
Negligence of the dispatch personnel	216	The ambulance and the medical team reach with delay the patient	The nearest medical team was not identified
Inadequate professional training	210	Deliver an inadequate medical, healthcare service on request (during application)	Medical, healthcare service delivered improperly
Logbook un-complete (no fill-up)	200	Failure in confirming the technical verifications of the ambulance when takeover	The ambulance is technically non-functional
Breaking the rules of asepsis	196	Use inadequately the disinfected instruments	Instrumentation disinfected and the possibility of infected the patient
Failure to observe traffic rules	189	Unsafe transportation for the patient to the medical care unit (hospital)	Inadequate transportation of the patient by ambulance
Failure disinfection	168	Use disinfected instruments	High possibility of infected the patient
Insufficient knowledge of the territory	160	Inaccurate identification of patient location	Inaccurate identification of the patient location and delayed in arriving at the request place
Insufficient time (time crisis)	160	Delays in the identification of the applicant requirements	Delay in retrieving the call

Source: Authors development

3.2. Management risk assessment using the OnRisk platform

The risk assessment process developed using the OnRisk platform has confirmed the causes and effects discovered using the FMEA method. Additional categories of problems, related to risk have been discovered and they are shown in Table 4.

Table 4: New risks identify with the OnRisk platform (related to the patient risk management and the medical staff risk management analysis done) – brief overview

Risk assessment done in the general human-machine-environment system		
Human system	Machine system	Environment
Physical and emotional risks Psychological risks Stress risks Missing of a continuous training program (up-date of knowledge) Chemical and biological risks Risk of depersonalization	Risks associated with the logistics system Vehicles/ambulance maintenance risks Technical medical equipments (on the ambulance) maintenance risks Road traffic risks	Exposure to biological risks Waste (as chemical, biological etc.) risks exposure

Source: Authors development

4. CONCLUSIONS AND FUTURE WORK

The complexity thinking of modern organizations management moves from the classical systemic theory to the business process management approach (including the simple cause – effect analysis in preserving the quality of all organization's processes). This has suggested that relationships between

subsystems are more important than the parts themselves and furthermore, minimum specifications yield more creativity than detailed plans. Treating organisations as complex adaptive systems (evolving in a dynamic environment) allows a more productive management style that has been developed. These were preliminary observations that have anticipated the tendency of organization's agility of today. In this context, the risk management process becomes of great importance considering the positive impact on: the general conditions of health and safety at work, concern and respect of human rights, concern and respect for employees working conditions, and generally it is an important dimension of the organization's sustainable development. In addition, the preoccupations on risk management have been considered as the core of high quality health care services (as system's out-put) together with the continuous improvement of the services quality. The goals of risk management are prevention, analysis, decision making, settlement, mitigation, and process improvement.

In this context, in the first part of the paper there was presented an introduction related to the importance and motivation (based on OHS actions at the European level and ESENER-2 statistics) of risk management. Second, a brief overview of the risk management proposed approach has been done. There have been shown the conceptual map of the knowledge management approach for the risk assessment. This approach could be useful for the risk mitigation initiatives as have been demonstrated through the case study (risk assessment for the ambulance and emergency intervention service unit). The application of FMEA method has prioritized actions towards risk prevention and mitigation, but the results of the risk evaluation with the OnRisk platform has underlined new categories of risks. This risk assessment opportunity for the ambulance service has to be adopted as prophylactic approach for reviewing and re-define its risk management strategy.

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