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Knowledge management in the function of risk assessment

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Abstract

This paper deals with knowledge management in the field of risk. It presents a diagram of the knowledge management process with its application to the area of risk assessment in occupational health and safety. There are examples of risk assessment in which knowledge management has been used as a tool for taking measures that define decisions at the stage of process designing. This has also affected the prevention of risks or provided for preventive activities in order to forestall occupational injuries.

Keywords: risk assessment, knowledge management

Introduction

Nowadays, owing to contemporary technologies, businesses are largely open and observable, and at the same time exposed to various unexpected events. In order to achieve better results, every company should have the risk management included in the overall management system. Risk management is very significant for any process or system, and the awareness of it has risen in the recent years.

In the risk management methodology, there are common rules and steps, but every field requires specific knowledge that is necessary for understanding the circumstances and the environment in which the risk management should be conducted.

Risk and knowledge could be two elements of business management that are considered separately, but since business models are constantly changing, management is looking across the organization to make strategic planning, information systems theory, risk management and knowledge management integrated. (Rodriguez & Edwards, 2008)

The risk management should be supported and enhanced using knowledge management.

"Risk management *is* knowledge management" (Neef, 2005).

A great deal of literature discusses knowledge management within one organization, along with the challenges encountered in KMS (knowledge management system). This paper deals with the knowledge management at a broader level, at the level of the whole society within one area – the area of the occupational health and safety. Every company has a need and an obligation to take care of the issues in this area and carry out a risk assessment of the workplace and working environment.

The goal of the risk assessment of the working process is to mitigate the risk of harm to an acceptable level. This goal can be achieved by redesigning technological processes, equipment or

operations. Even better results can be reached for the processes that are in the design phase or at the establishment stage (Nikolic, Sotic & Sotic, 2012).

Knowledge management is a systematically organized process for accumulation, organization and transfer of knowledge in such a way that employees could use it for improving their efficiency and productivity. This process involves primary holders of knowledge, who transfer it to other participants who adopt it, and become distributors of knowledge. Knowledge sharing can be horizontal and vertical, as well as combined. Also, the very act of work organization is a part of knowledge management.

Good work organization and knowledge sharing are the basis and precondition for the complex problem-solving. We often solve some problems by applying knowledge management and we are not aware of this. However, knowledge management has existed and has been applied as a tool (Massingham, 2010) for solving a lot of problems in various areas. Knowledge management is multidisciplinary since the application of knowledge from one field could help resolve issues in another one. The example underlying the previous statement is when we use the knowledge management in the risk assessment process and at the same time, we tackle some technological problems. (Nikolic, 2014a; Nikolic, 2014b; Nikolic&Bilic, 2014).

About risk

The basic scheme of risk management consists of: risk evaluation, risk determination, and implementation of measures reducing the risk to an acceptable level. In the risk assessment method, it is essential to evaluate the risk and its elements (likelihood, frequency, and harm) (Macdonald, 2004). There are quantitative, semi-quantitative, and qualitative methods.

The risk assessment in the field of occupational safety and health (OHS) is based on the systematic recording and monitoring of all risk factors, i.e. threats and hazards in the working process. The risk assessment is conducted related to these facts (Takala, 1998; Regulation, 2006, 2009). Such an assessment could be carried out only by a person who is well informed about the particular working process, who is an expert in the particular field of work.

The risk assessment is an orderly, documented, and continuous process that requires monitoring, updating, and making amendments on a regular basis in order to maintain the preferred level of risk. The risk assessment could be conducted in various systems and fields of work. In this paper, we are dealing with the risk in the field of OSH (Harms-Ringdahl, 2001).

Methodology of risk assessment consists of the following steps (Nikolic, 2012, Nikolic & Ruzic, 2009):

- *Recognition and identification of threats and hazards in the workplace and in the working environment.* This includes a good knowledge of technology, organization, equipment, and all means of work. Therefore, it requires the participation of experts in the field in which dangers and harms are expected.
- *The risk assessment in relation to the threats and hazards*. Assessors use the established methods of risk assessment, which also requires knowledge. Thus, this fact makes risk assessment a part of the knowledge management process.

- *Identifying controlling mechanisms and measures for the elimination, reduction or prevention of risks*. Such measures can be: constructive (redesigning of equipment, technology and working processes), organizational, etc. and require superior knowledge and expertise of assessors. Knowledge and expertise are of great significance since the risk assessment requires not only superior knowledge in the field of risk, but also with expert technical knowledge. The solution that is used for the prevention, reduction or elimination of risk, in fact, is used to solve the encountered technological problem. Such an outcome is a result of using knowledge management as a tool applied to risk assessment knowledge, which is aimed at solving specific technological problems.
- *Conclusion* – related to the Act of risk assessment
- *Measures for maintaining the achieved level of risk.*

The method of risk assessment (Nikolic, 2012) is based on a mathematical interpretation that the risk is the product of: probability of events, the size of the damage and the frequency or duration of exposure. The values of these elements are taken from the table formed on the basis of experience, and historical data. The value of certain elements of risk (probability, damage and frequencies) can be reduced by implementation of certain measures. The consequence is the risk mitigation to a negligible level. In special cases, the probability of events can be calculated through a mathematical function f (x), which is used in this paper, instead of selecting from a table.

Risk assessment is considered successful if it provides for: assessment of all the risks workers are exposed to; risk assessment for each worker; risk assessment of the workplace technologically recognized; risk assessment in every working environment.

In the paper an analysis is conducted related to occupational health and safety in order to resolve technological and technical issues.

Risk assessment method and case studies are from the area of occupational health and safety, but they could be customized to other fields, what has already been done successfully (Nikolic & Ruzic, 2009, b), (Nikolic, 2010). In that case the result would be solving a problem from other business area

Knowledge management in the risk management

Since the topic of this paper is knowledge, we analyze the flow chart of knowledge for risk management in the field of OSH (occupational safety and health). This area is broad and involves various working activities, so it would not be realistic to assume that knowledge could be created and accumulated in-house in every company.

It is obvious that the existence of different levels of knowledge, arranged in horizontal and vertical hierarchy, is necessary. The purpose of knowledge at any level is to provide for management of technological processes at different levels and of different significance. In this case, a flow chart has four levels. The first two, being the same, make one horizontal level, and there are three vertical levels.

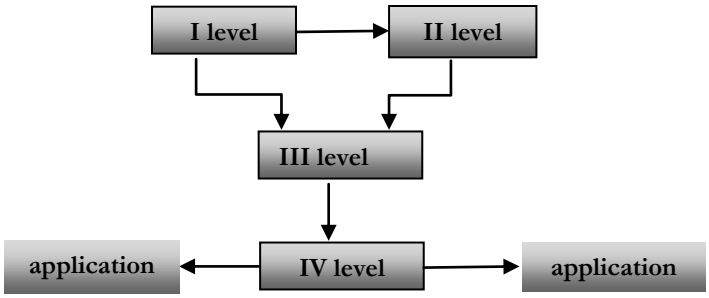

Figure 1: Levels of knowledge

These levels are identified as a result of the author's experience of many years in the field of OHS as a trainer and researcher. Required levels and knowledge transfer are perceived by investigating and solving various problems in many companies, as well as teaching in this area

The first level is the primary source of knowledge. This knowledge is the sum of expertise (in the field of labor) and theoretical and practical knowledge in risk assessment. The existence of this source of knowledge is a precondition for the knowledge of the second level. The first source of knowledge is usually external for most companies.

The second level of knowledge is a horizontal flow of knowledge transfer. It refers to the transfer of the knowledge of the first level to the experts in particular fields. The knowledge of the risk assessment is shared. This transfer is important because it reinforces the first level in terms of ease and faster transfer to the lower levels.

The third level is the transfer of knowledge from the first or second level to the level of the user. Thus, the recipients of knowledge on the third level are the persons in charge of OSH in companies, who are partly further transmitters of knowledge. The initial knowledge of these users is the basic knowledge of risk assessment, supported by more or less empirical technological knowledge.

The fourth level refers to users and holders of knowledge within the workplace. This knowledge is related to a particular workplace, it is purposeful and it is not transferable to a new level, either horizontal or vertical.

Levels and transfers

There are two knowledge management strategies based on the two knowledge types, tacit and explicit knowledge. Explicit or codified knowledge is represented in various codified forms like documents, data, software code, whereas reliance on this knowledge is based on the people-to-documents approach. Tacit knowledge is the result of personal experience that includes scientific and technological expertise. Tacit knowledge is not easy to codify as it is in the people's mind, and it represents the person-to-person approach (Hansen, 1999).

We can say that the first level is basically tacit knowledge that is formed on the basis of accumulated experience, theoretical knowledge and practical skills. This knowledge should be

transferred horizontally and vertically. The horizontal transfer must be carried out after thorough theoretical training and after a number of practical examples which require active participation of the trainees since they should learn through practice.

It is assumed that these trainees are experts in specific areas, with great experience. This is the only way how they can learn to manage risk in their particular area of work. Thus, their knowledge becomes tacit knowledge as well.

As to the vertical transfer of knowledge, it is preferable to use the explicit system, i.e. to make certain documents comprising guidelines, recommendations, lists of hazards, protection measures, established methods of risk assessment, etc., so that this knowledge could be acquired and transferred to the workers at the fourth level.

Risk management provides risk assessment of the specific technological operations. The methodology of risk assessment and the tools of knowledge management can solve various technological problems and ensure the establishment of new rules and work organization. In order to solve such problems, it is necessary to have certain knowledge. This knowledge is "possessed" by different people holding completely different posts. Each one of them has the knowledge of their field of work. In addition, there is some knowledge that must be brought in and transferred to the staff who is involved in the problem-solving. Therefore, it makes sense to discuss the existence of different levels of the knowledge management system.

According to Rodrigez and Edwards (2008) risk modeling knowledge is supported by:

• Connection between the risk management employees and risk modeling experience

• Integration and synthesizing of the risk modeling process.

• Using best practices and lessons learned in the risk modeling process.

• Learning from consideration and mathematical modeling review.

It is clear from the above-presented flow chart (Figure 1) that the first and second levels of knowledge are crucial for the existence of knowledge transfer. Instructors from the first and second levels are experts with extensive experience of risk assessment, who should introduce a group of OSH managers and technologists to the risk assessment in particular areas. Thus, instructors, who are engaged outside the company as the first or second level of knowledge source, should train the third-level group of trainers. The trained managers and technologists are ready to participate in solving concrete problems and to be trainers to safety managers working at the lower levels as well as to the workers and technologists involved in a particular working process.

The trainers then should work together with the workers from the fourth level to solve their problems in specific workplaces.

The Figure 2 shows the categories of employees who are involved in the process of knowledge transfer in order to manage risks. The process management is applied to establish certain technological trends and solutions.

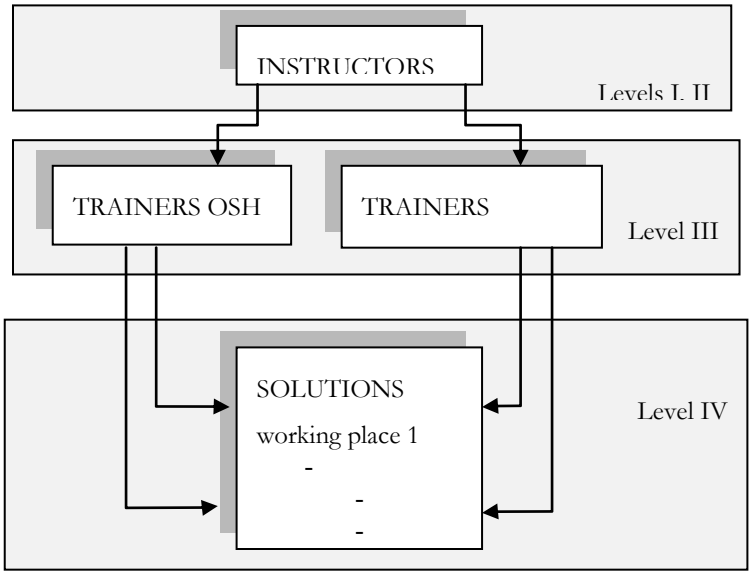

Figure 2: Transfer of knowledge

Case studies

In this paper, we apply the risk assessment for safe and healthy work and knowledge management with an aim to solve certain technological problems. Therefore, we need two types of knowledge: the first is the knowledge of risk assessment and another one is the knowledge of technological operations. Both types of knowledge cannot be consolidated in one, or even in two persons. The combination of these two categories of knowledge holders is sufficient for successful defining of various technological demands.

The following examples illustrate some of the opportunities implied.

Example 1 (Nikolic, 2014a)

The task is to conduct the risk assessment in manual handling of load during the installation of grassland. By applying the known ways of risk analysis, we could come to the conclusion that the worker is exposed to the load to a greater or lesser extent and nothing else.

But, expertise, knowledge and experience in addressing such problems, provide the answers to the following questions as the solution to this case:

- What is the length that grass strips should be cut at so that this job could be done even by women?
- Determine the tempo of work and rest schedule for workers.
- How to fit this case study into the existing risk assessment.

All these questions were answered by providing the correction of the load, which is necessary because of the repetitive cycle of lifting, angle of asymmetry (due to the turns and twist of the body), the position of the load during repeating, and quality of handling of the load (ISO / IEC, 2003; Nikolic 2013; Nikolic&Bukta, 2013; Nikolic, 2014b).

Thus, knowledge management as a tool in risk assessment enabled the defining of the load dimensions, in order to make it possible for female workers to do such tasks, and then it defined the tempo of work and rest schedule by determining the cumulative weight of the load.

Example 2 (Nikolic & Bilic, 2014)

In this case, the risk of a lathe worker is determined. The observed hazardous events are the intrusion of wood chips in the eyes and the direct hit of the key. Protection measures are determined to reduce the risk to an acceptable level.

The trajectory of the key can vary, with a varying range or height of the trajectory, but it is always within the same plane. Many other workers might be present in the plane of the flying key trajectory if the path of their movement overlaps or crosses the trajectory of the key.

Another risk comes from wood chips that can harm the eye. The range of wood chips should be analyzed.

The elements of the dynamic calculation (Milosavljevic & Nikolic, 2013; Morin, 2008; Nikolic & Petrovic, 2012) are defined according to the equation of the square parabola and the parameter equations:

The greatest height, the horizontal distance *d* at which the greatest height is reached, impact force and the furthest range of the key are determined.

The figure 3 shows the greatest height and range at a particular time, the furthest range of the key and impact force for different number of revolutions of the chuck head.

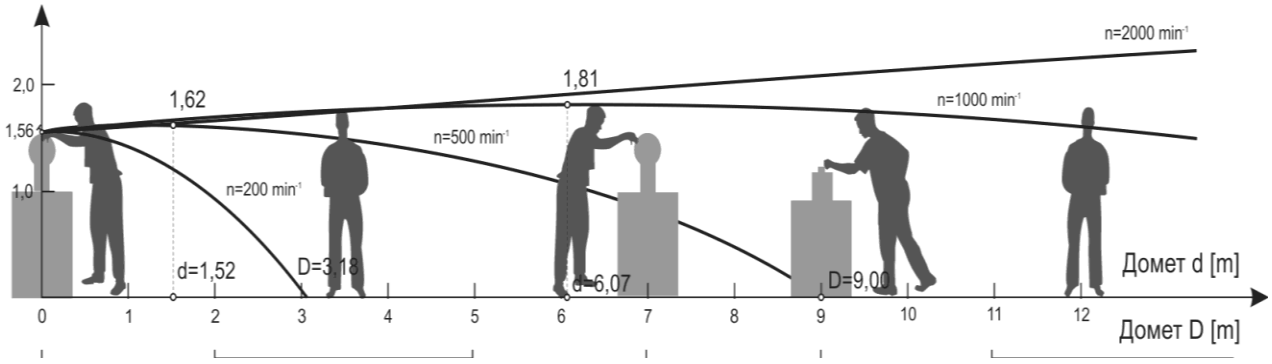

Figure 3

The next figure represents the parabolas of the propelling chips, which are the result of the variable intensity of hazard resource for different values of the chuck head resolutions and of the diameter of the working piece.

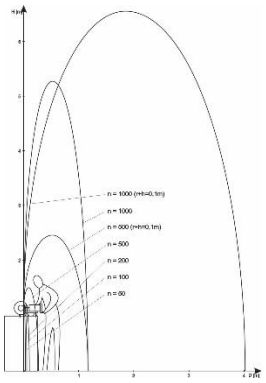

Figure 4: Parabolas of the propelling chips

In view of such hazards, prevention measures and the measures for their reduction have to be applied even at the stage of designing. This should be applied not only to the working environment but also to the workplace.

By adequate arrangement of machines at the designing stage, certain risks can be avoided. Machines could be arranged parallel to each other, or at certain angle, or opposite each other etc.

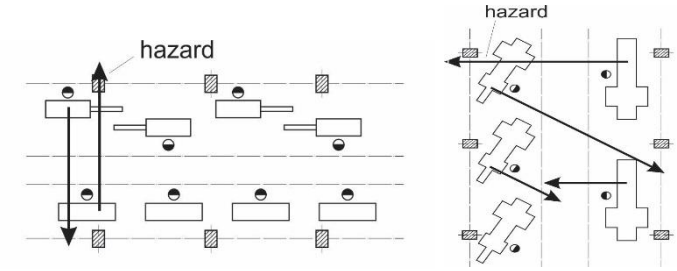

Figure 5: Arrangement of machines

Safety devices are frequently used on no grounds, i.e. without any imminent danger, while at the same time we do not use the measures which are needed. The example, noted here, obviously shows that in the plants for metal processing at lathes, the visitors are advised to use protective goggles and head protective helmets.

Discussion

In the case of manual handling of load, the holders of the third level of knowledge had to be informed about all the facts related to that particular working process, which was the obligation of the knowledge holders of the first and second levels. Thus, it was necessary to deal with the topics such as: regulations (OSH Act, the regulations on risk assessment, the regulations on load), and the methods of risk assessment selected in terms of their applicability to particular companies. The international and domestic standards in the field of knowledge transfer were of special importance. These topics are directly related to the specific fields of work, such as: working at height, muscular and skeletal disorders, good practice and so on. It is clear that the benefits of explicit knowledge, codified in the form of standards and regulations, are immense.

This shows that the recipients of this knowledge must obtain thorough and quality knowledge of certain areas to be able to transfer it and put it into practice on the fourth level – in the workplace.

When tackling the problem using the applied methodology, it is observed that this is a two-way process. It starts from the existing conditions and ends when the solution or solutions are reached. Then it goes backwards, starting from the solutions and ending by the establishment of a new state of conditions.

The risk assessment is conducted for a working process that has already been established. Upon the assessment, the measures for the prevention, reduction and elimination of risk are carried out. This is a regular procedure, i.e. an assessment flow. It is possible to reverse this process, beginning from the stage of the system designing towards its establishment. This provides for the incorporating of the risk prevention measures at the stage of designing. The latter way is typically used in mobile and temporary construction sites, where the risk assessment is carried out on the basis of technical documentation. The risk assessment is conducted before the work process starts and the measures prescribed on the basis of the risk assessments become a prerequisite for the beginning of the construction works.

If we consider the examples provided in this paper, we could see that a combination of these two systems produces solutions. Precisely, we observed the working system that already exists, and then we singled out one hazard. Using another approach – knowledge management, we reached technical solutions. Instead of classical risk assessment, knowledge management was used as a tool for finding solutions.

It is important to emphasize that in any case the solutions are in the areas of preventive action. It makes sense for safety because it prevents the risk. For technological and technical system these solutions are relevant in the design phase. In a business system that would be making decisions. For instance, analyzing fire risk assessment, for building or its contents, according to the same principle, we would get similar results. The size of the fire sector, distance from the fire brigade etc., would become decisive elements in the design of buildings, rather than be treated as measures for risk reducing.

Conclusion

The methodology of risk assessment is repeatedly mentioned in this paper. It consists of specific and defined steps, whereas the procedures and methods of assessment should be well-known. This classical approach is a typical example which, apparently, does not require knowledge management.

However, dealing with such issues, which occur in various areas, we have recognized the need for improving and extending the existing knowledge, which should result in the acquiring of special skills. The acquired expertise in the particular field will open up opportunities for a completely different approach to a problem. The provided case studies show how the solutions are reached as a result of applying this process and demonstrate the ways of dealing with technological and technical issues in a quality manner.

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