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## Risk Management in Area of Security and Protection of Health During the Work

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### 1. Introduction

The risk comes along with a particular form of responsibility for a chosen entrepreneurial decision, the success of which is influenced by current and future position of the firm. That is why all employees should think about the consequences of their acting before making any decisions. It is not enough to select the solution but it is also necessary to analyze all possible varieties and to choose the one that will be suitable from long-term point of view and not only from short-term one. In the developed countries, where the market mechanisms have been operating for many years, the management and decision making of the company representatives in the field of anxiety is called '**risk management**', i.e. risk management in much wider sense. It is a process of risk management having influence on the success of the company.

Risk management is systematic process, in which risk is identified, analyses and defines optimal way for risk managing during minimal cost aspects and respecting of systematic goals of the subject. Task of risk management is mainly achieving of maximal security and property protection by elaboration of optimal strategy for risk management as main bearer of possible future damages. Risk management can save great volume of finances for the firm in case of negative risk events. At the same time it is necessary that risk management could solve risks completely, not only superficially, and that it could calculate with mutual influencing of risk factors.

The main aims and concerns of the chapter will be as follows:

- According newest knowledge to contribute to the solving of risk evaluation and increasing of firms effectiveness from the long term view
- To show to the necessity of new evaluation processes in conditions of market economy and to underline their contribution
- To analyze mentioned theoretical processes of management for risk influence and their practical solution
- To define methods for risk management
- To identify possible risks appearing in the firms
- To analyze and evaluate risk influence to the conditions of the firms

In present varied time there is not possible to predict facts and events with 100% certainty. In practice it is therefore not possible to state ahead possibility of most proper risk covering

in the firm. Advantages, respectively disadvantages resulting from every possibility are raising in connection with concrete conditions in which firm exists.

It is necessary that management of the firms would follow during risk management following activities (Seňová, Antořová, 2007):

- Risk analysis, monitoring and measurement, respectively evaluation of the risk in internal or also in external environment of the firm, meanwhile managers would state conclusion and recommendation for top management
- Definition of the goals in area of risk decreasing (that are consistent with definition of risk strategy in the firm – for example what risk to omit and what risk to decrease, how to minimize cost connected with risk strategy application to the growth of the firm), stating of the most proper strategy of the risk decreasing.
- Consequently stating and implementing of most proper method for risk decreasing to the conditions of concrete firm – with aim to state or diversify revenues (strategy of expansion of narrow group of client) or diversification of business suppliers, etc.
- Evaluation of applied risk strategy of the firm in practice and consequently application of chosen method for risk decreasing. (It is also necessary to comment that concrete using of such method can bring new risks!) Person (or group of employees) – so-called risk manager is responsible for such risk policy of the firm.

Harmonization of the risk management with firm's strategy is extraordinarily important. Many firms applied basis of risk management and they plan to orientate to their better using and obtaining of higher value added. How can firm achieve it? By higher standardization, conception Access, by limitation of activities duplicity and by using of department for risk management with aim to support and coordinate such processes.

Main function of department for risk management is securing of control and processes in area of risk management in the whole firm in mutual agreement. That means complex problematic when majority of the firms does not have enough experiences. There is therefore proper to count in some cases with experts that will help company to avoid serious problems.

Comprehensive upgrading of safety in the beginning of the 21st century is one of the most important tasks facing the whole society, from national governments, but also from management of each company. Occupational Safety and Health is an area, which until recently was underestimated and neglected. This trend ceases to be valid. Organizations are well aware of the need for changes in access to health and safety, because the level of safety and health at work significantly influences whether the organization becomes recognized, successful and well-established on domestic and foreign markets (Šolc, 2007).

At the beginning of industrial revolution technical equipment were at very low level as for the safety. With time development technique puts in connection with growing level of complexity of the system and equipments always higher demands for security and therefore it must be evaluated systematically with regard to the man that works at this place, as well as to the man that is only moving over working place as third person. From the mentioned results that goal of every activity must be effort not to threaten man. European Agency for SPHW collects statistics in area of SPHW and researches from whole world. One of the ways for comparison of SPHW systems with EU member states is annual „weak of SPHW“. Some of the statistics during last years in area of SPHW are as follows (OSHA, 2008):

- every three and a half minutes in EU somebody dies due to the work reasons,
- every year in EU die 142 400 people due to the occupational diseases and 8 900 people due to the consequence of working accident,
- yet one third from total number of 150 000 deaths can be allotted every year to the dangerous elements at working place in EU, including 21 000 deaths, caused exposed asbestos.

## 2. Determination of risk conception

Conception of risk is generally known. In spite of risk knowledge there is not existing generally accepted definition that would define this conception expressly. Expression „risico“ comes from the Italian language and it means primary stumbling block that must seafarers overcome during their voyages. In older encyclopedias risk is explained as courage to overcome danger, resp. dare to make something. Two main elements of the risk are as follows:

- Occurrence of unwanted consequences;
- Uncertainty (probability) that such consequences will increase.

Manifestation of risk is danger. Goal of risk analysis is to identify real danger. During danger identification it is necessary to look after future, but sometimes we must look also after past and to find out reasons why risk was underestimated, or badly estimated, resp. neglected. Appropriate risk can be given to every single danger. For danger identification it is important expert experience, and counting also with relationship of individual to the danger. Danger is every real threat of inspected object or process damaging.

We know following danger:

- Absolute – threatening everybody;
- Relative – its realization influences only some groups of inhabitants, for some other group it can be positive (for example hurricane – threatens inhabitants of the country, but for building firms and insurance company it can be positive).

Generally in the firm's practice danger is relatively high.

Every activity, but also inactivity in the firm brings along higher or lower level of risk. Way of such risks management decides considerably about success or non-success of the firm at the market and therefore it is one of the important criteria for evaluation of management effectiveness. It is important to evaluate these parameters due to the risk determination. When any of the risk elements exists, risk does not exist. Risk is therefore combination of uncertainty and unwanted consequences that can be represented by the way of symbolic equation:

$$\text{RISK} = \text{UNCERTAINTY} \times \text{UNWANTED CONSEQUENCES} \quad (1)$$

According dictionaries dangers can be many times described as „risk sources“, meanwhile risk is considered as „chance of unwanted consequences rising.“ Danger simply presents origin and source of the risk. It includes „probability“, by which such source can create real damages. Risk depends not only on the danger, but also on the protection measurements, accepted against danger. Risk can be expressed in symbolic equation:

$$\text{RISK} = \text{DANGER} / \text{PROTECTION MEASUREMENTS} \quad (2)$$

Such equation establishes concept of human intervention and risk management. Danger is always source of the risk. It is physical situation with potential to influence negative facts for people, property and living environment.

Lately concept of risk has obtained economical dimension that means possibility of loss. Explanation in MacMillan dictionary about modern economy results from risk conception as possibility that some event will arise with certain probability that will be different from the expected state or development (Pollio, 2003).

In present time risk can be viewed also in negative sense as something that could restrain achieving of stated goals. Negatively limited risk is connected mainly with short term risks at the level of operation management, when risk has form of defects, error, cheat and accident. With growing time horizon and growing level of management risk is defined also as something positive that firm can use for its future possible development. Business risk presents danger for business non-success, connected at the same time with hope for achieving of good economical results. Loss extend can be evoked by violation of financial stability of the firm and it can lead to its decrease.

### 3. Processes of risk analysis

General process of risk analysis must include following parameters – risk detection, evaluation of reasons and probability of risk occurrence, evaluation of possibility for rising of damages and consequences, evaluation of possibility for risk decreasing, evaluation of risk influence to the cost and profit of the firm.

In mentioned model its individual elements are illustrated and explained according following principle (Figure 4):

1. Internal environment – it gives direction for whole organization existence and it serves for every other elements of firm's risk management. It includes philosophy for risk management in organization, attitude of organization against risk, its integrity and ethical values;
2. Stating of firm's goals – such goals must exist before management will identify events that could influence their achievement. System of risk management must support choice of the goals that are correspondent to the aim of organization and they are consistent with attitude of organization against the risk;
3. Identification of events – internal and external events, influencing goals achieving in the organization, must be identified and risk and occasion must be distinguished. Occasions are backwardly included to the strategy creation or to the process of goal determination;
4. Risk evaluation – risk are analyzed, considering their probability and possible impacts, and it presents basis for training how they can be managed. Risks are evaluated according basis and residual base;
5. Reaction to the risk – decision about answer to the identified risks. Here we can have avoiding the risk, acceptance of the risk, decreasing or sharing the risk. decision will depend on the attitude of organization against risk;
6. Control activities – they are orientated for using of policies and processes that verify if reaction to the risk is effectively realized;

- 7. Information and communication – they are important as identified, obtained and provided in demanded time by this way that people could fill their tasks. Effective communication must be in the whole organization;
- 8. Monitoring – system for management of firm’s risk that is followed as a whole and in case of necessity there can be changes in this system. Monitoring is made through permanent managerial activities or by specific way (Čunderlík, 1993).

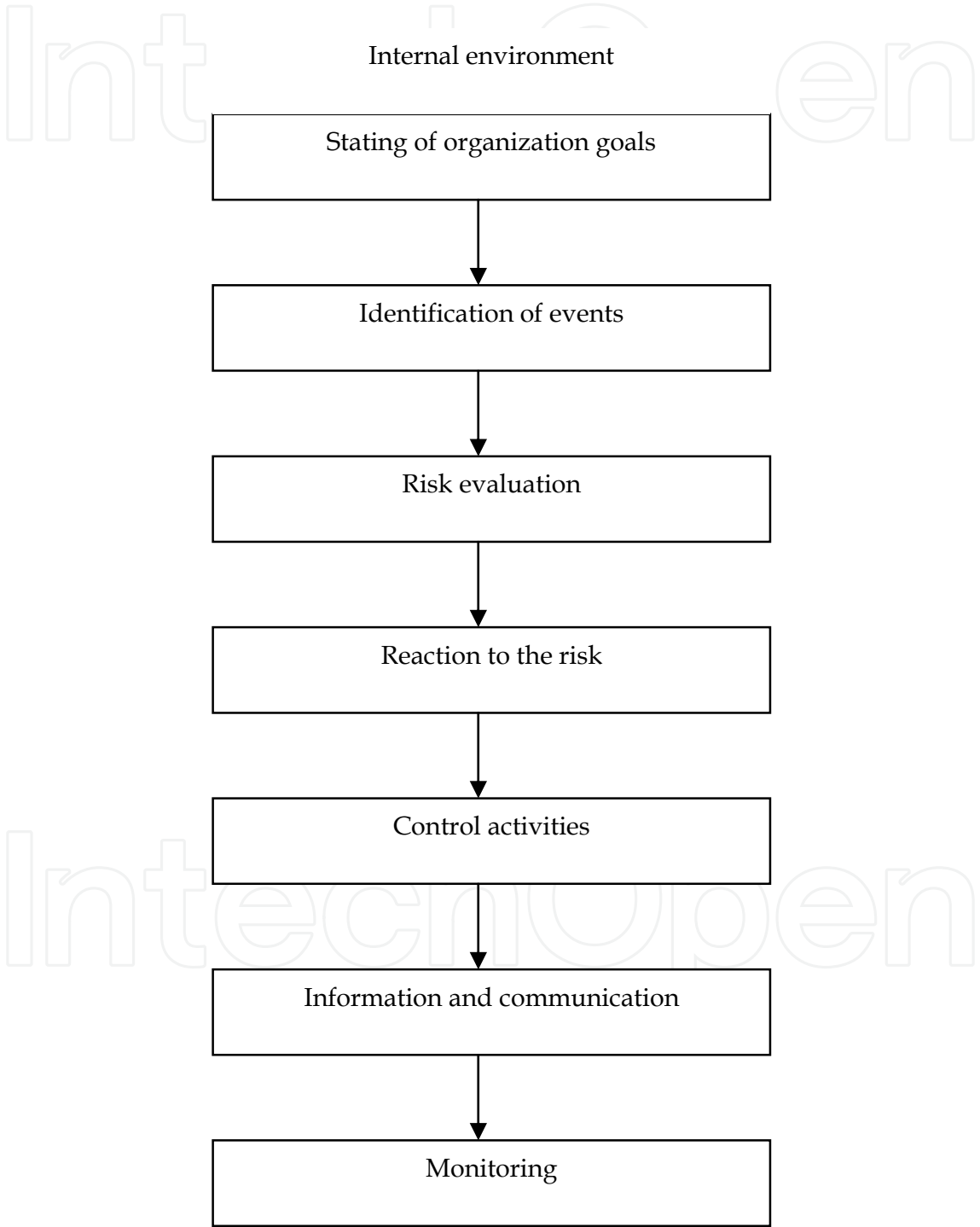


Fig. 1. Process of risk analysis



Risk analysis should serve to the following:

- for review providing about risk evaluation at the individual professions during making of working activities and about demanded security measurements,
- for proving of process and results from evaluation (for example to the control organization) with concrete results,
- for review of risks at the working places and during activities that should be available for responsible employers that manage and assign the work,
- for basis for training, informing of employees about the risks, how they can prevent such risks and how to work safely, information about risks is necessary to provide to the employees mainly during acceptance to the employment, during rendering to the other working place, during conversion to the other work, during installing of new working processes, etc., (Seňová, 2008).

#### **4. Conditions for successful risk management in the organizations**

Risk management is not successful in every organization. In monograph „Risk management in the firms and other organizations“ (Smejkal and Rais, 2003) there are specified conditions that organization must fill with aim to manage possible risk successfully:

1. there is clear defined strategy of the subject regarding its main goals including risk strategy,
2. there is existing complex system for risk management, supported by proper information system (it can be replaced by system for decision support, expert system, etc.)
3. management put enough attention to the risk management and there are persons that have responsibility for risk management
4. there is existing functional firm's culture and ability to develop in the future and to adapt to the new risk possibilities.

Functional firm's culture is necessary due to the work with people that are main potential for successful risk management. Firm's management in area of risk management must secure following activities:

1. risk analyzing, its measuring and monitoring (evaluation) in the internal as well as external environment of the firm (including determination of conclusions and recommendations for the firm);
2. goals defining in area of firm's risk decreasing (corresponding with defined risk strategy of the firm – for example which risks can be neglected, which risks can be decreased, how to minimize costs, connected with application of risk strategy to the conditions of firm's growth, etc.), determination of most proper strategy for risk decreasing (for example counting also with revenues that could be achieved during risk decreasing). But manager will receive such risk in advance, commonly they are stated by superior strategy of the firm;
3. consequent determination and implementation of most proper method for risk decreasing to the conditions of concrete firm (for example to determine if revenue or business suppliers will diversify, or if risk will be retain);
4. evaluation of applied risk strategy of the firm in practice and consequent application of chosen method for risk decreasing (risk manager is responsible for this activity).

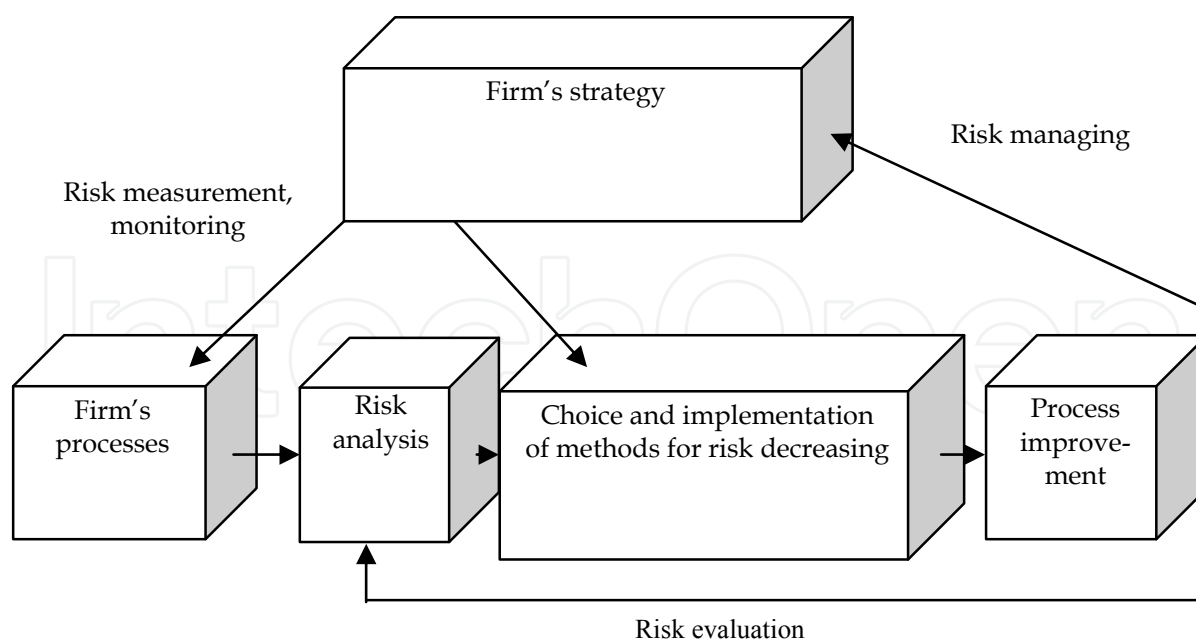


Fig. 2. Process of risk analysis in the organization

#### 4.1 Necessity of risk management

In the firms that are near crises and bankruptcy there is generally situation, when middle managers will not deliberately warn top management about the problems. Most common reason is fear about working place, effort to make no problems, or own comfort. Top management in such precise situation is characterized by not reacting to the problems. Therefore there are arising such situations, when everybody knows about the problems, but nobody wants to speak or solve it. Such problems are called „quiet killer“ of the firm. Therefore main condition for risk management is open communication and its configuring on the principles of cooperation and open environment.

Basic problems of firms' bankruptcy is disorderliness, abandonment of financial management, late payment of taxes and fees, long time of invoice payment, interruption in the production, not qualified production and fluctuation of key employees. Among external reasons of future problems belong stagnated or very unstable markets, increased pressure of competition that is still better and better, decreasing of lasting employees and negative external economical influences. When organization wants to defend from such negative changes (risk) without problem, it must from the beginning to count with risks and prepare for the problems. Risk managers must know how to predict consequences and probability and know how to remove such consequences from organization successfully (Al - Zabidi, Čulková, 2011).

During risk management it is most important to respect law of effectiveness. Costs for risk management minus costs for risk bearing must be lower then profit from risk management. Such situation is applied also in so-called secondary risk impacts that are not visible at the beginning. Risk management must be positive in the cycle of following eight areas: finances - public relations - SPHW - ethics - internal environment of the firm - employees - collective - nature. When risk management will be positive for every mentioned phase and costly acceptable, risk can be considered as successfully solved (Seňová et al., 2008).



## 5. Rising and development of the system for SPHW Management

Formalized managing systems have been appearing yet at the beginning of 80-ties from last Century. In present time there are existing three areas, in which there are implemented managing systems:

- Management of quality,
- Environmental management,
- SPHW management.

In the history of managing systems management quality systems have appeared at first, they are orientated to the product, resp. to its quality. Historically younger then management of quality systems are systems for environmental management that deal with impact of the whole life cycle of the product to the living environment, from this result that such systems are orientated to the process of production. Youngest systems are systems for SPHW management that are orientated to the organization employees (man). Every human activity bears also risk of various type and volume. Therefore it is necessary to know such risks, eliminate them and manage them (Šolc, 2007).

### 5.1 Development of SPHW in European Union

Area of SPHW registered in EU at the end of 80-ties extended transformation. In 1985 for area of SPHS there were more then 300 directions that described detail security demands. But experts determined that this system of prescriptions stopped to be functional for application in the practice. European Commission decided to cancel every direction and to create new system of directions for area of SPHW. Obligation of every employer and employees has been included in one prescription that determined installing of tools for management and support of SPHW improving. Such new philosophy for improving of SPHW was constructed on three basic principles:

- Work security must be organized with regard to every aspects, connected with the work
- Employer must know and evaluate what can be real danger for employees at working place and to accept responsible measurements – he must evaluate risks,
- For improving of SPHW level it is necessary cooperation of employers and employees, therefore employer is obligatory to involve employees to the solving of SPHW tasks.

New prescription was accepted yet in 1989 – Frame Direction No 89/391/EEC about performing of measurements for improving of SPHW. This direction defines basic principles for prevention; states frame responsibilities of employer and employees. Performing direction results from this direction that determine minimal demand for security and protection of employees health, working condition and working environment with orientation to the working tools, working environment, personal protection working tools, manipulation with burdens, work with screens, asbestos, chemical elements, etc. Technical direction about machines No 89/392/EEC has also frame character, since it install system for balance showing and marking of products as CE. This direction is connected with following directions about technical claims for individual types of products and technical equipments. There is for example electric equipments, elevators, cranes, pressure vessels, etc., but also toys, fire arms, etc. Such directions are marked as maximal security demands.

When these demands are fulfilled, any member state can prevent or limit installment of the products to its market and to the service. That means securing of free moving of the goods (STN OHSAS 18001:2009).

## 5.2 Development of SPHW in Slovakia

One of the conditions for agreement about affiliation to the EU that Slovakia enclosed with member states was demand to harmonize Slovakian legislative with legal system of EU. Law about SPHW installed new institutions that had not any tradition in Slovakia:

- risk evaluation
- policy of SPHW
- representatives of employees,
- SPHW commission,
- plant health services,
- etc.

In 2001 there was published performing Instruction of Government, by which there were implemented individual directions of EU. For proper application of new prescriptions in the practice it is necessary to find out solutions in the technical norms, manuals for good practice and expert literature. By entrance of Slovakia to EU also European legislative started to be balanced and harmonized gradually with Slovak legislative. Basic Slovak law is law of National Council No 124/2006 from Body of Law about SPHW (Law no.124/2006). Subject of the law is general principle for prevention and basic conditions for providing of SPHW and for excluding of risks and factors, causing rising of working accidents, occupational diseases and other damages of health during the work. Slovak organ that is responsible for control of respecting the measurement in area of SPHW and that performs inspection is National Inspection of Work (NIW). Experts for area of SPHW are covered in not profit organization Slovak association for security and protection of health during the work and protection against fire (Šolc, 2003).

According direction about SPHW No 89/391/EHS article 6, employer is obligatory in the frame of his responsibility to make measurements that are necessary for securing of safety and protection of employees health in the frame of prevention from threatening during the work and securing of information and training, as well as providing of information and trainings and securing of necessary organization and tools during changed situations with goal to improve existed situation.

Employer is evaluated risks, connected with safety and health of employees, he is providing improving of the protection level, that is made for employees with regard to the ability of the workers and he makes proper measurements that only trained workers have access to the space, where there is serious danger. Measurements connected with security, hygiene and health protection during the work cannot be included in any case to the financial costs for workers.

According article 12 employees are obligatory to take care of their own security and health protection. They must know to use properly tools and equipments, dangerous elements and transport vehicles. They must inform employer immediately or other worker with specific responsibility about safety and health protection in working situations that are causally considered as situations threatening safety of the workers.

Review of some other law in area of SPHW is following:

- Law No 547/2009 from Code that fills and changes law No 311/2001 from Code, Labor Code as amended by late prescription,
- Law No 140/2008 from Code that fills and changes law No 124/2006 from Code about security and health protection during the work and change and filling of some law as amended by law No 309/2007 from Code about change and filling of law No 355/2007 from Code about protection, support and development of public health and about change and filling of some laws,
- Law No 126/2006 from Code about public health and change and filling of some laws,
- Law No 125/2006 from Code about inspection and change and filling of law No 82/2005 from Code about illegal work and illegal employment and about change and filling of some law,
- Institutional Law No 323/2004 that changes and fills Institution of Slovak republic No 460/1992 from Code in amendment of later prescriptions,
- Law No 261/2002 from Code about prevention against serious industrial accidents (Šolc, 2003).

### 5.3 What is system of SPHW management?

For securing of permanent organization prosperity it is necessary that there would exists leading managing mechanism able to secure proper functioning of organization. Generally there is applied principle that only 15% of problems must be properly placed on the employees and 85% of problems should be secured by managing system. As in other areas of organization management also in area of SPHW it is necessary to install effective system of management.

#### 5.3.1 Holistic access to SPHW

When policy SPHW is determined by so-called holistic access, that means orientation to the SPHW solving with regard to every aspects, connected with work. In first step there was single understanding of security and health area, physical, psychical and social comfort. Appeal to holistic access is in certain sense appeal to integration of every aspect, connected with the work. By this way there is motivation for applying of integrated system of management.

#### 5.3.2 Systematic access to SPHW

Present practice in SPHW management was orientated mainly to the fact that situation at working places; state of technical equipments and works performing would be according prescriptions for SPHW providing. New process of SPHW is orientated to the emphasis of new ways finding how to avoid shortages. Such process results from following principles:

- not observing security rules is not accidental, but it is consequence of not proper work organization,
- also working accidents, occupation diseases and not proper working conditions are greatly consequences of not proper work organization,
- asserting of SPHW is effectively only in case when it means not only amending of individual shortages, but also searching the reasons of their appearance and performing the measurements for removing of shortages rising,

- system security depends from the level of technical solution, but also from working environment and from people that create part of the system, that means from total elements of the system: man – machine – working environment, that means also the fact that organization solution is as important as technical solution,
- effective avoiding accidents can be achieved also by targeted analysis of shortages and unwanted events that yet not caused damages (semi accidents, events without consequences),
- solution of the SPHW tasks is orientated primarily to the organization and system measurements.

	OLD ACCESS	NEW ACCESS
ACCESS:	technical	systematic
Methods:	solving of negative aspects (accidental consequences)	prevention, avoiding, negative aspects
Orientation:	machines, equipments, working environment	human factor, culture of work
Principle(comparison):	hardware	software
Management:	active	participative
Responsibility for SPHW:	safety technician	management and every employee
Experts:	technicians, engineering, hygienists, psychologists, sociologists, risk experts	systematic analytics

Table 1. How SPHW process is changed

6. Safety and protection of health during the work – Legislative demands, claims and duties of employees and employers

SPHW is part of employee’s protection that is obligatory in Slovak legislative. Every employer must have elaborated risk references that influence employees at the working place. Security and protection of health during the work (SPHW) is such position of working conditions that excludes acting of dangerous and damaging factors to the employees. Main goal of measurements for providing of SPHW is to prevent rising of working accidents and occupational diseases. Every employer is therefore obligatory to perform measurements with goal to remove reasons of threatening of life and health of employee and to create secure working conditions (Čulková, Teplická, 2008).

Working accidents or harms belong among not proper working conditions that are connected mainly with objective and subjective reasons:

- Objective reasons means not proper working conditions that are connected mainly with not proper technical level of machines and equipments, protection equipments and personal protection instruments, bad space arranging of the working place, negative

acting of physical factors at working space, as well as objective reasons, resulting from social and psychological conditions at the working place.

- Subjective reasons are caused by human factor (Antošová, Csikósová, 2007).

Securing and protection of health during the work is necessary in every production firm. Decreasing of various working injuries, and by this way also to avoid various dangerous situation and risks at the working place can be achieved only by knowing and performing of basic rules for behavior at the working place, by performing of claims and duties. It is especially important that leaders of the organization would know these rules perfectly and that they would observe them. Only these people can proper direct, warn their subordinates and by this way to secure fluent service without working injuries. Due to the mentioned reason leaders must be experts to this area and therefore they must proceed training regularly. Elimination of the risks that threaten health and lives of the employees should be main task of every employer. Necessary step for such important task is identification of every dangerous step, connecting with individual working activities and stating of risk sources that result from every identified danger, including present as well as planned security measurements according Labor Code and Code about Security and Protection of health during the work. Employer must therefore accept effective measurements with aim to decrease risk appearance to the minimal level (Drahten, Hermann, 2007).

**Risks are connected mainly with:**

- Threatens, resulting from working activity,
- Threatens, resulting from negative influences of industrial prisoners and other factors of working environment (including ergonomics),
- Threatens, resulting from the suggestion, construction, installation, standard activation, standard service (failure free service or situation when there was any defection), standard disconnection, maintenance, repair, liquidation and demounting (life phases of technical equipments, machines, tools, buildings, etc.).

**Team that secure evaluation consists from minimal following persons:**

- Leaders at the corresponding level of organization unit,
- Employees that perform evaluated activity (including every activities, performed at the technical equipments during regarding of every situations on the equipments),
- Representative of the employees for Security and Protection of health during the work,
- Expert employees for SPHW (from area of security),
- According the need also specialists from other expert department (maintenance, reserved technical equipments, fire protection, etc.).

**Process of risk evaluation is made at least once a year and in following cases:**

- Preliminary inspection of working place, resp. Installing of equipment of the service,
- Change of legal or other claims that could have impact to the risk evaluations,
- Change of the activity, practice, service conditions, products and services,
- Change of technology, processes and equipments,
- Change of purchased and used raw material and material, including products of production processes,
- Changes following the results of the management exploring,
- Appearance of shortages following the results from the SPHW verification,



- Appearance of shortages following the results from observation, inspection, employees or their representative initiative,
- Appearance of accident or near accident,
- Direction of the organs of state department for control over SPHW.

Results from the process of risk evaluation must be provable consulted (report about acquaintance) with employees that are exposed to these risks. Managing of SPHW must be dynamical process that secures permanent improving. Rules of the SPHW managing system result from the following principles (Balážiková, 2009):

- policy of the organization SPHW contents basic aims that have to be achieved in SPHW and program of its realization includes mainly process, tools and way of its performing, responsibility for SPHW conception is on the highest level of management, that means management have to develop and state own SPHW conception that is in balance with the conceptions of the organization,
- management should also secure that this conception will be understandable, applied and unbroken,
- system of SPHW management must put emphases mainly to the prevention, damages prognosis not to the removing of the shortages, system must be active not reactive,
- it is necessary to applied the system in every area of the organization activity: development, projection, construction, input material, used technology, machines, tools and equipments, control, service, maintenance, human sources management, etc.,
- there should be secured responsible, specialized working powers, clearly stated their responsibilities, competences, work description, vertical and horizontal relations, organization structure should be properly stated in the frame of total organization management,
- system must have stated flow of information and secured feed back that enables to compare system with achieved results and with level of techniques and science,
- important element of the system is documentation, every principles and processes have to be written, every activities should be documented and marking of the products have to be secured,
- principle of the system is also plan method with aim to secure that production operation could run in managing conditions, by prescribed way and by this way there can be achieved possibility of adequate operative management,
- acting of the management system demands also control system after any operation, special attention is given to the choice and preparation of the employees at every level: methodology of preparation, motivation and employees involvement,
- application of corresponding security prescriptions, norms and processes, identification and evaluation of the risk, results analysis is main methods during creation of the system,
- feed back.

Installing of the system for SPHW management and its pragmatic linking with management of other firm's activities creates assumptions for:

- *Risk minimization of employees health damaging and losses on lives,*



- *damages minimization and losses* caused by working disability due to the injuries and occupational diseases and by interrupting of the production due to the technical equipment damage,
- *Optimization of working process*, orderliness, plan method, installing of order and discipline at working place,
- *engaging of the employees* to the task of SPHW, increasing of motivation and creativity of employees and their responsibility for own health,
- *improving of working and social comfort* of employees, improving of working conditions and labor relation,
- *work culture increasing and improving* of firm's image and competitiveness (Seňová, 2008).

**6.1 Risk matrix, process diagram of risk management SPHW, program HELP in Slovakia firms**

Employees that made risk analysis must have competence and they must know how to manage problems of the given area in the firm. Risk evaluation can be managed also by single employer, mainly when there is small firm or service. Employer can use also external services for risk evaluation through various experts and advisors (for example certified specialists from area of work security). But employer should avoid using of external services in areas that should be solved only in the frame of the organization.

In present time we can call persons that deal with risk management in the firm as risk managers or they can be security techniques. These people need information during risk analysis and evaluation at working place:

- Risk factors and risks that exist yet as well as information about reasons of their rising,
- Used materials, machines and equipments, Technologies,
- Working processes that are used during the work and information about employees that use such working processes,
- Development of accident rate at the individual working places,
- Number of threatened persons, extend of anticipated damages,
- Legislative and technical norms and demands for security, etc (Seňová, Antošová, 2007).

**6.1.1 Point method for evaluation of individual factor from working environment**

Type	Level	Description of the event	General description
Often	A	It will appear probably often	Expected continually
Probable	B	It will occur several times during the living period	Frequent
Casual	C	It will occur occasionally during the living period	Several times
Rare	D	It is not probable, but possible	Expected only rarely
Not probable	E	Almost excluded	It is possible only very rarely

Table 2. Probability table

Type	Category	Health damaging	Technology damaging
Catastrophic	I	Killing	Loss of the system
Critical	II	Serious injury, affection	Large damaging of the system
Marginal	III	Easier injury or affection	Low damaging of the system
Negligible	IV	Less then easier injury	Negligible damage of the system

Table 3. Consequences table

RISK MATRIX				
Probability / consequence	I catastrophic	II Critical	III Marginal	IV Negligible
1 often	1	3	7	13
2 probable	2	5	9	16
3 casual	4	6	11	18
4 rare	8	10	14	19
5 not probable	12	15	17	20

Table 4 Risk values determined by point method (combination of probability and consequence)

Scale of the risk

Number values of the risk can be ranked to the four groups that characterize level of the risk.

Point range	Level of risk	Criteria of security
1-5	Not acceptable	Dangerous system, permanent threat of damage, necessity to end activity immediately
6-9	Unwanted	Not proper security, probable possibility of damages, measurements with short term determination
10-17	Acceptable with inspections	Risk cannot be accepted in spite of the low possible consequences, measurements must be accepted
18-20	Acceptable without inspections	System is classified as secure, but it can be improved by planned reformation

Table 5. Scale of the risk according point method

Risk evaluation is process of probability evaluation and evaluation of seriousness of damaging effect to the people due to the exposition of dangerous factor during defined condition from defined source that consists from determination of danger, exposition evaluation, estimation of relation of amount and effect and risk characterization and determination of evaluation uncertainty. Acting of individual factors of working environment depends mainly on the way and length of exposition and on the reaction of employee’s organism, resp. on the measure of his tolerance or resistance against given factors. That means not only single risk factor is influencing the employee, but commonly several factors influence him at the same time.

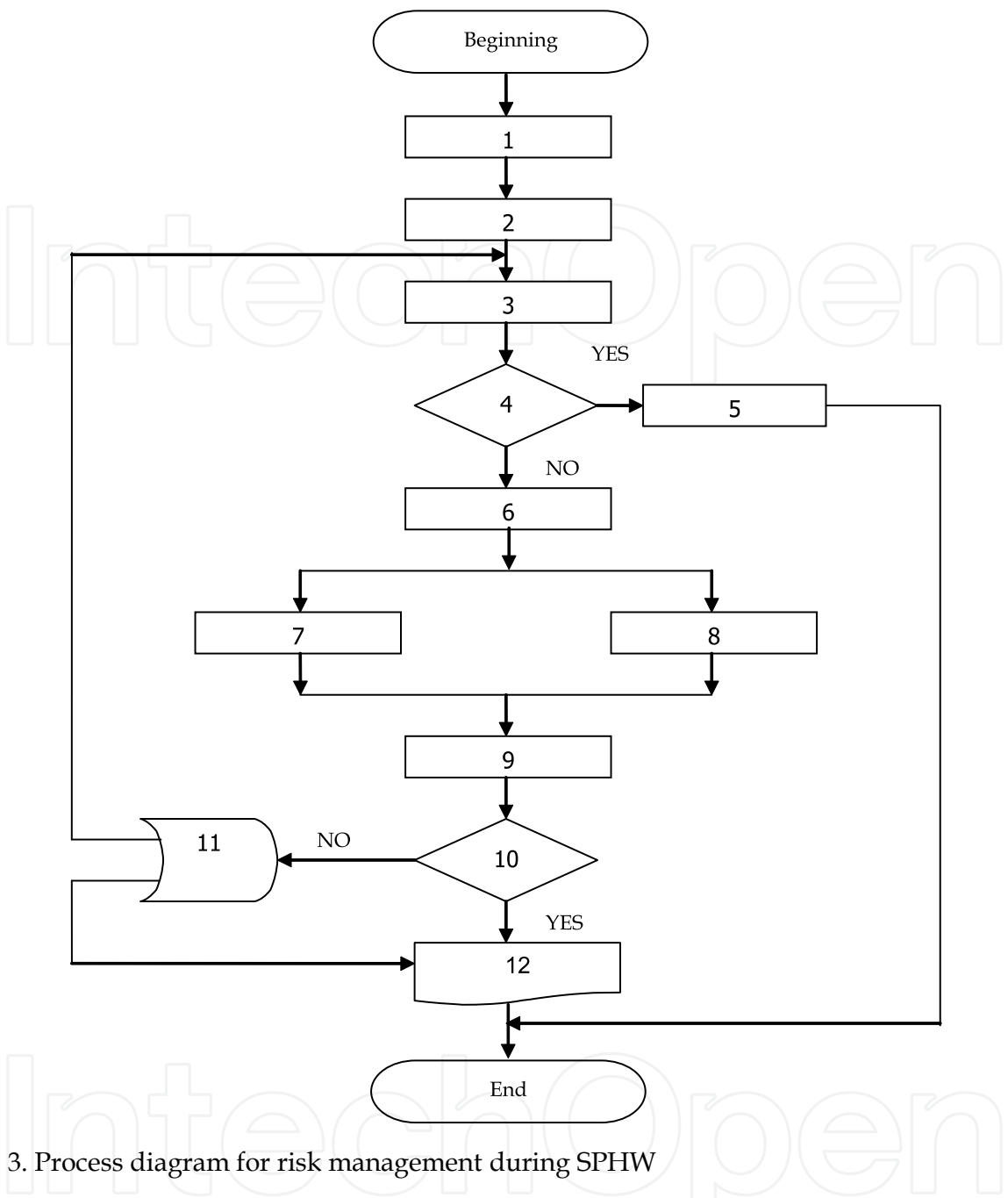


Fig. 3. Process diagram for risk management during SPHW

According the fact that we demand from the evaluation of working environment quality we can define following goals of evaluation process:

- Evaluation of critical, typical and prescript factors of working environment,
- Evaluation of chosen factors, Evaluation of factors classes,
- Evaluation of complex quality of working environment.

One of the modern tools that are used in the business practice is in present time in Slovakia program H.E.L.P. that combines principles of work security, industrial hygiene and health. Application of this system enables to avoid losses at the equipments, interrupting of the working activity and injuries of the employees. The system is define following:

- Principles – principles, at which program H.E.L.P. is based, proved liability of the employer to take care of the health, security and comfort of every employee.
- Strategy – strategies show to the way how to achieve successful prevention of the losses. The limit by proper and single way what employee must made when he have to achieve losses prevention.
- Techniques – systematic processes, according which there are implemented strategies for loss prevention. They are determined by this way that they could help to perform concrete task connected with loss prevention.
- Methods - instruction how to install program H.E.L.P. at the working place. Tools of the program are formulary, documents and other information sources, used during realization of instructions mentioned in the program methods (Seňová, Antořová, 2007).

*Risk management can be realized in any firm according following process diagram:*

*Description of process diagram for risk management during SPHW:*

1. Determination of examined space – in this phase there are determined margins of evaluated space.
2. analysis of examined environment, that means:
  - analysis of every persons (employees, clients, visitors) that could be in the space or that are in the space,
  - analysis of any working activity that is performed in the examined space, or that could be performed in this space,
  - content of examined working space, that means what exists in this space – energetic distribution, technical and technological equipments, materials and raw materials, dangerous chemical elements, etc.
3. identification and analysis of dangers and threats means finding of real and potential dangers, threats and their characteristics – for example searching of present experiences with service of given system, searching of documentation, direction, inspections, investigation of accidents etc.
4. during identification of dangers and threats that connect with service of technical equipment it is necessary to analyze every phases of equipment service – delivery, installation, maintenance, damage, etc.
5. in case when identified danger or threat can be immediately removed, it is necessary to realize measurements for its removing immediately and by this way process of risk management is performed. This step means removing mainly of common, immediately removable defects.
6. according risk character to state risk type (security risk, health risk, technical risk, etc.) and goal of threatening (people, material, production) in accordance to which goal given threatening can have negative influence.
7. to determine probability of threatening occurrence.
8. to determine severity of threatening and its consequence. During determination of severity it is necessary to count always with worst reliable consequence that can appeal.
9. determination of risk level (for example by the way of higher mentioned risk matrix). Best way is to divide this matrix to three risk levels:
  - acceptable risk
  - temporary acceptable risk (marked for example by blue color)
  - not acceptable risk (marked for example by red color).

- 10. in case when risk is acceptable – there are not demanded any measurements for its further management. In case when risk is temporary acceptable – there is demanded timely limited measurement for its further management and registering to the risk register. In case when risk is evaluated as not acceptable – it is demanded immediate making of relevant measurements and also evidence to the risk register.
- 11. working activity that connects with not acceptable risk cannot be performed to the time of measurements realization, which will decrease risk value to the temporary acceptable level.
- 12. risk management is orientated to the management of not acceptable and temporary acceptable risks with goal to remove them completely or decrease them to the level of acceptable risk (Seňová, Antošová, 2007).

6.2 Evaluation of risks in the practice

Risk evaluation for the firms makes specialized firms or special trained workers. Suggestion for risk evaluation in the frame of SPHW can be as in the following example:

Method: Simple point method for evaluation of risks SPHW

Single point method is comprehensible and simple for evaluation of threatening measure. It is proper method for risk revision at the working place that is stated as basis for safety measurements at the service. It is expressed by semi quantitative way – by ranking of the points 1-5 during probability evaluation and by points 1-4 during consequences evaluation and in this case also by word description of consequences severity. During risk measure evaluation there is used definition of risk by matrix of numerical risk evaluation that is stated from the values of consequences and frequency.

$$R = P \times C \tag{3}$$

P – Probability of rising and risk existence – it determines estimation of possibility that there will be any unwanted event and probability that there will be unwanted event. This parameter results from frequency of risk situation rising in the frame of evaluated system. The more is employee exposed to the influencing of various risk factors, the higher is probability of risk rising.

Value	Probability	Frequency of origin	Time period of threatening
1	Very low	Event origin is almost excluded	Almost impossible threatening
2	Low	Event origin is low probable, but possible	Very rare threatening
3	Middle	Event will arise sometimes during life cycle of the equipment, or activity	Rate threatening
4	High	Event will arise several times during life cycle of the equipment or activity	Time threatening
5	Very high	Event will arise very often	Continual threatening

Table 6. Parameters of point method – probability

C – Consequence that expresses level, severity of consequence from unwanted event. By this parameter there is evaluated measure of employee health damaging that result as an influence of unwanted event, caused by risk situation.

Value	Consequence	Characteristics of consequence
1	Negligible	Less then easy injury, negligible damage of the system
2	Few important	Easy injury, beginning of the employment disease or lower damages of the system, financial losses
3	Critical	Heavy accident, employment disease or extend damaging of the system, losses in production, big financial losses
4	Catastrophic	Killing as a consequence of working accident or total damaging of the system, losses that cannot be replaced

Table 7. Table for parameters of point method – consequences

R – Risk – combination of two parameters – probability (P) and consequence (C) – it determines resulting value of risk. Lowest level can be 1 and highest value is 20.

Consequence/ frequency	1	2	3	4
1	1	4	6	12
2	2	7	11	13
3	3	10	15	17
4	5	12	16	19
5	8	14	18	20

Table 8. Numeric expression of risk value – point method

According point range risk during simple point method is ranked to the four categories. Resulting value of risk determines reality, if given risk is accepted or if it is necessary to accept some measurements for removing and minimizing of the risk.

Point extend	Evaluation (criteria)	Necessity for security measurements
1 – 3	Acceptable	System is secured, common processes
4 – 11	Mild	System is secured with condition of service training, inspections, etc.
12 – 15	Unwanted	System is not secured, it is necessary to accept technical, other measurements
16 – 20	Not acceptable	System is not acceptable – immediate applying of protection measurements

Table 9. Point range of the risk and necessity for security measurements



**Method: Extensive point method**

During risk evaluation by extensive point method there is used extensive definition of the risk by following expression:

$$R = P \times D \times I \tag{4}$$

Single measure of risk during extensive point method is calculated by single multiplication of three parameters and difference against single point method (where  $R = P \times C$ ) it is extended by parameter „I“ – influence of SPHW level (opinion of evaluator). This method of risk evaluation is expressed by semi quantitative way – by adding of point value 1-5 during probability evaluation and point value 1-5 during consequence evaluation and point value 1-5 during evaluation of SPHW influence with following description by words.

From risk value R and classification of objects security results that it is necessary to make safety measurements for risk decreasing or removing.

P – Probability of risk rising and existence – is determines estimation of possibility that unwanted event will arise, and probability how often this unwanted event will appear. This parameter results from the frequency of risk situation rising in the frame of evaluated system. The more and more frequently is employee exposed to the risk factors influencing, the higher is probability of risk rising.

Class	Probability	Characteristic of probability
1	Not probable	Undesirable event is almost excluded
2	Random	Undesirable event is low probable, but possible
3	Probable	Undesirable event can arise
4	Very probable	Unwanted event will probable arise
5	Permanent	Undesirable event will arise probably very often

Table 10. Evaluation table for extended point method

During evaluation of probability for accident and unwanted event rising we come out from:

- data about past accident rate
- estimation during working place inspection
- data about control – internal, external, performed expert inspection, exams

Probability of accident is influence by following factors:

- measurable factors: duration of danger influencing, time of exposition, system parameters, temperature, noise, dust, speed, speed of unwanted event rising, etc.
- not measurable factors: human factor, qualification, attention, stress, quality of control, revise and experimental measurements, reliability and maintenance of safety measurements, etc (Mikloš, 2004).

Determination of the influence of individual factors severity to the probability of concrete negative event rising is subjective view of evaluators according higher mentioned factors.

C – Consequence that determines level, consequence severity of unwanted event. Measure of employees health damaging is evaluated by this parameter that results from influence of unwanted event, caused by risk situation.

Class	Consequence	Characteristic of consequence
1	Negligible	Small injury – less then easy injury, negligible financial and material losses
2	Low important	Easy injury, disease, beginning of occupational disease, small financial and material losses
3	Important	Serious injury demanded hospitalization, bigger material and financial losses
4	Critical	Heavy occupational injury with permanent consequences, occupational disease, great financial and material losses
5	Catastrophic	Deadly, mass injury, losses leading to liquidation

Table 11. Characteristics of risk consequences through extended point method

During estimation of accident consequence we come out from:

- severity of accident or health damaging – deadly, mass, heavy, serious accident demanded hospitalization, or ease, small accident,
- extend of damaging – one person, more persons, material damage,
- measurable factors: type of accident: other, heavy, deadly, number of threatened people, system parameters (height of working place, weight of manipulated burden, etc.),
- not measurable factors: relationship between danger and its effect

I – influence of SPHW level that determines evaluation of risk situation by own evaluator. This parameter includes regarding management level, time of threatening influence, qualification of employees, working ethic, using of protection working tools, level of prevention, state and age of technical equipments, severity of accident or health damaging, level of maintenance, performing of control, revision and examination of technical equipments, influence of working environment, separation of working place, stress, etc.

Level	Influence of SPHW level
1	Negligible influence to the probability and consequences
2	Low important influence to the probability and consequences
3	Not negligible influence to the probability and consequences
4	Important, great influence to the probability and consequences
5	More important influences to the probability and consequences

Table 12. Level of risk according extended point method

R – risk – it is simple multiplication of every three parameters – probability (P), consequence (C) and influence of SPHW (I) that presents resulting risk measure ( $R = P \times C \times I$ ). Lowest value can be 1 and highest value is 125. According point extend risk during point method is

ranked to the five categories. Resulting risk value expresses reality if given risk is acceptable or if it is necessary to accept measurements for risk removing or minimizing.

Risk category	RISK	Point extend	Evaluation of security (criteria)	Necessity of security measurements
1	Negligible	1 – 4	Acceptable security	It is not necessary to make measurements, but informing is necessary
2	Middle	5 – 15	Acceptable risk during increased attention	It is necessary to plan improvement, trying to achieve improving, training of employees for risk managing
3	Precarious	16 – 50	Risk is not possible to accept without protection measurements	It is necessary to accept technical, organizational, security measurements
4	Unwanted	51 – 100	Not proper security, big volume of injuries, unwanted events	It is necessary to make immediate improving measurements, or measurements with short term filling
5	Not acceptable	101 – 125	Permanent threat of injury, uncovered losses	It is necessary to stop activity immediately, displacing from the service

Table 13. Risk evaluation according extended point method


**Method: complex method for risk evaluation SPHW**


Common practice in small and middle firms demands such methods that are not sophisticated as for the time and expert knowledge, but on the other hand methods that assume knowing of real state of existed technology. During application of the method it is necessary to realize what elements of the analyzed system it is possible to neglect and what elements must have increase attention. System according this method means data of elements that provides certain activity. Common systems, in which human risk are existing, are created by human factor (man with his abilities) that acts in certain working process and uses working subjects. Principle of the method lies in proper ranking of point value to the individual elements of the system and defining of acceptable risk (Mikloš, 2004).


Using of this method is applied mainly in area of human risks. Method includes also some of basic elements of human factor analysis, as well as evaluation of working environment and working subject risk. Possible applying has in every periods of technical life of given system. It is proper mainly for immediate risk evaluation with aim to apply immediate, not complex measurements.

Point values are allotted to the concrete risk that exists in the working process and is function of individual elements of the system. Such values enable then evaluation of total risk. Process of risk evaluation in working process is characterized by following steps:

- Evaluation of total risk for working subject,
- Evaluation of environment influence,
- Evaluation of ability to manage the risk,
- Calculation of value for result risk,
- Comparison of calculated value of risk and acceptable value of risk,
- Performing of measurements.

1. Determination of possible damages	Suggestion for evaluation	Total value
Dangerous injuries that have easy consequences (impact, easy cutting, contusion)	<div>1</div>  <div>10</div>	<div>S=</div>
Dangerous injuries that have heavy consequences (fractures, deep cutting, etc.)		
Dangerous injuries that have permanent consequences		

2. Exposition of threatening (frequency and time)	Suggestion for evaluation	Total value
Temporary middle exposition (for example automatic machines that are without failure, rare intervention, etc.)	<div>1</div>  <div>2</div>	<div>Ex=</div>
Very often repeated exposition (intervention of hands during every working cycle, for example molding)		
Often or permanent exposition (for example machines with manual leading – automatic machines, saws that are failed and therefore interventions are necessary, etc.)		

3. Probability of injuries occurrence (connected with factor „equipment“)	Suggestion of evaluation	Total value
Low (unavailability of secured elements, reliable, practical and secure protection equipment, during intervention necessity to secure switch off)	<div>0,5</div>  <div>1,5</div>	<div>Wa=</div>
Middle (complete protection equipment, in good state, but not practical, therefore many working moving are realized without protection equipment)		
Great (lacking or not sufficient protection equipment, possible dangerous intervention during machine services)		


4. Possibility to avoid or minimize the loss	Suggestion of evaluation	Total value
Big (by timely informing of persons it is possible to avoid losses)	<div>0,5</div>  <div>1</div>	<div>Ve=</div> <div></div>
Small (mechanism of threatening is very rapid and unexpected)		


Table 14. Risk evaluation caused by equipment (machine)


5. Total evaluation of factor „equipment“

M = S x Ex x Wa x Ve

(5)

M=

1. Arrange of working place and zone of intervention	Suggestion of evaluation	Total value
At one level	<div>0,5</div>  <div>1</div>	<div>Ua=</div> <div></div>
On many stable levels		
Using of tools (ladder, foot step, ...)		
Visible and spacious working ways		
Near and not correspondent working ways		

2. working environment	Suggestion of evaluation	Total value
Not sufficient lighting	<div>0,3</div>  <div>0,6</div>	<div>Ub=</div> <div></div>
Not disturbing noise (acoustic signals are very good absorbed)		
Disturbing noise (acoustic signals are absorbed not sufficiently)		
Comfortable climate (temperature, dust, dampness, air circulation)		
Disturbing, heavy climate		


3. Other charging	Suggestion of evaluation	Total value
Proper arranging of elements for service, screen, indexes, information offer and material flow		<div>Uc=</div>
Not proper arranging of elements for service, screen, indexes, information offer and material flow		
Easy physical charging (lifting and moving of the charge ...)		
Heavy physical charging (lifting and moving of the charge ...)		


Table 15. Evaluation of environment influence


4. Total evaluation of factor „environment“

U = Ua + Ub + Uc

(6)

U=

1. Qualification of the person	Suggestion of evaluation	Total value
Expert qualification, educated person with skills and experiences		<div>Q =</div>
Expert qualification, educated <u>or</u> skilled person		
Expert qualification, educated, but not skilled and experienced person		

2. Physical and psychological factors	Suggestion for evaluation	Total value
Proper psychical ability of the person for responsible work		<div>j =</div>
Not proper psychical ability of the person for responsible work		




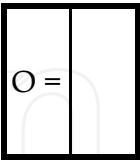
3. Job organization	Suggestion of evaluation	Total value
Formalized and used written working directive (firm’s directive), prescription that will work safely		
Formalized, but not always used written working directive that will work not safely		
Not formalized, not used written working direction or firm’s prescription that is not effective		

Table 16. Ability of the person to manage the risk

4. Total evaluation of factor „person“

$$P = Q + j + O$$

(7)

P=

Risk evaluation at working place by complex method:

During risk evaluation at working place it is necessary to determine at first values for acceptability, that means values for risk acceptance. According this method level of acceptance is during acceptable risk at level 10 points (next illustration at the figure).

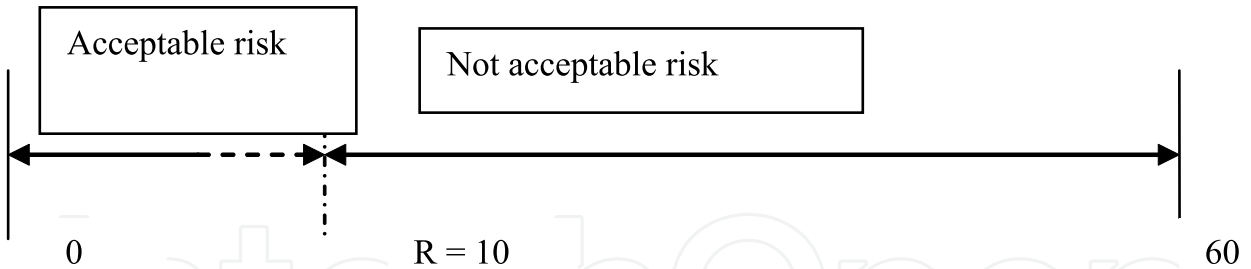


Fig. 4. Level of risk acceptance

Resulted risk value is calculated according equation:

$$R = M \times U - P \times (M/30)^*$$

(8)

\* Comparable value M/30 counts with significant ability of the person to manage the risk during his increased level.

Violation of rules for SPHW leads to the employees’ accidents or possible death of employee. In this case working place is automatically inspected by inspectors from Institution for work safety that put penalty and make investigation of life and health threatening. At the same time they make also preventive inspections at the working place with aim to control observation of SPHW rules. Employees many times put protection tools

due to their hindering, they consciously ignore them or they forget them and work without them (Pačaiová et al., 2009).

## 7. Conclusion

In the present time job security and medical care of personnel isn't only the question by meet legislative requirement of society, but the question of total firm culture too. The role of management is manage and make a decision about questions of society prosperity and together admits and educates personnel to assume the responsibility for quality and job security. Culture of security is term, which show obvious, but action, which must be realize to effective implementation to firm, is very difficult. To know what is safe, what involve menace and risk, and know these terms to apply, increase claim for safety inspector and other personnel too. In today's 21st century, the time improving the technology and its expanding use among more workers, the labor force continues to threaten various risks. It is therefore necessary to address the organizational issues, how to prevent or eliminate the impact of these risks.

Effective system of SPHW management is basis for good working conditions, security and protection of health during the work. It leads to higher effectiveness, productivity and quality of work, it means success of organization. By good level of SPHW can avoid irreparable losses on human lives and health during working accidents, occupational diseases and material damages. System of SPHW management is part of top managing activities in the organizations. High quality of life must result from permanent training and education mainly in area of application of various methods for risk management systems, as well as from knowing the reality that there is not existing zero risk but minimal risks are existing. Investment to SPHW and preventive activity presents finally profit for whole organization. Employers must know that bad working conditions and risk working places can present for organization further expenses and business goals can be effectively combined with care for security and protection of employees' health.

It is necessary to deepen in the chapter maximum of the factors that yet influence and will influence whole process of risk management. Due to the fact, that system of risk indexes is permanently developed, chapter will mention basic aspects in area of risk management from the global point of view in economically developed countries. During risk management it is very important to respect laws of effectiveness. Costs for risk management versus costs for risk bearing must be lower in credit of risk management. This is connected with so-called secondary risk impacts that are not visible at the beginning. Risk management must be positive in the cycle of minimal such eight areas: Finances – public relation – safety and organization of health during the work – ethics – internal environment of the firm – employees – collective – nature. When risk management will be positive for every area and acceptable from the view of the costs, risk can be considered as risk that was successfully solved.

Conclusion of the chapter gives to the definition of contributions for development of theory and practice. Chapter can serve as a tool for easier defining and explanation of risk management and also for obtaining of necessary information for performing of effective decision of firm's management.

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The book "New Technologies - Trends, Innovations and Research" presents contributions made by researchers from the entire world and from some modern fields of technology, serving as a valuable tool for scientists, researchers, graduate students and professionals. Some practical applications in particular areas are presented, offering the capability to solve problems resulted from economic needs and to perform specific functions. The book will make possible for scientists and engineers to get familiar with the ideas from researchers from some modern fields of activity. It will provide interesting examples of practical applications of knowledge, assist in the designing process, as well as bring changes to their research areas. A collection of techniques, that combine scientific resources, is provided to make necessary products with the desired quality criteria. Strong mathematical and scientific concepts were used in the applications. They meet the requirements of utility, usability and safety. Technological applications presented in the book have appropriate functions and they may be exploited with competitive advantages. The book has 17 chapters, covering the following subjects: manufacturing technologies, nanotechnologies, robotics, telecommunications, physics, dental medical technologies, smart homes, speech technologies, agriculture technologies and management.

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