

## POSSIBILITIES FOR IMPROVEMENT OF RISK MANAGEMENT PRACTICES IN THE COAL MINING INDUSTRY OF THE FEDERATION OF BOSNIA AND HERZEGOVINA

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### ABSTRACT

*Current business environment and growing exposure to a wide range of risks require companies (especially the large ones) to raise a question of risk management, start treating it as a particular business function that needs special attention and for which they have to seek proper solutions within their organizational structure. This particularly affects the coal industry, where risk exposure is rather evident and makes risk management one of the key management issues in general.*

*A central point of the analysis includes companies in the coal industry of the Federation of Bosnia and Herzegovina (F BiH), where the management needs to be greatly concerned about protection against risks that affect this industry much more than other industries, in particular pure risks (those that involve only the possibility of loss and no possibility of gain). And if we add the so-called emerging or “newly developing” risks, which are still unknown even to risk management experts, it is clear that management of large companies have to take care of risk management culture development and seek adequate organizational solutions. On the basis of the conducted empirical research, the paper will show and appropriately explain the descriptive analysis results, accordingly used for establishment of the level of risk management efficiency in the coal mines of the F BiH and identification of certain weaknesses, whose elimination could significantly improve*

*the process and increase the level of economic protection for these companies.*

**Keywords:** risks, risk management, coal mines, economic aspect, Federation of Bosnia and Herzegovina (F BiH)

**JEL:** G-32, G-34, C-81, L-72

### 1. INTRODUCTION

The risk management culture in the companies in Bosnia and Herzegovina (BiH) is generally at a low level. The key reasons are mostly due to low level of economic development and the heritage from the previous system based on centrally planned economy, where the issue of accountability for losses was treated differently than in market economies. It will take a lot of time before BiH companies become aware of a systematic (holistic) risk management they face in business activities as a precondition for business success.

### 2. THEORETICAL FRAMEWORK AND HYPOTHESIS

There are different views by certain authors in respect of definition of risk management. Differences are mainly related to specification of risks which are the subject of management. Vaughan E. and T. (2000) define risk management as a scientific approach to problem of pure risks faced by individuals and companies. The definition emphasizes a “scientific approach” on the one side, and on

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the other side “pure risks faced by (large) companies”.

A scientifically based approach sees risk management as a process with several stages. As far as the number and content of the stages are concerned, there are different views. For instance, Tweedale and Joy (1997) suggest six stages of a risk management process, as follows: (a) establish the context (including defining the objectives and scope of the risk management process); (b) identify the risks; (c) analyze risks, so as to understand their causes, likelihood, and possible consequences; (d) assess risks, to determine the need and priority for attention given to the event in question; (e) treat risks by planning and undertaking the initiatives in operation, engineering or management, and (f) monitor and review progress and performance. Evans, Brereton, and Joy recommend the same number of stages but with their slightly different contents, as follows: (1) scoping, (2) information gathering, (3) identify risks, (4) analyze and evaluate, (5) treat risks, and (6) reporting and review.

However, generally we can single out the following key stages in risk management (Kozarević 2010, p. 2.8):

- ✓ risk identification,
- ✓ risk evaluation,
- ✓ selection of risk management method, and
- ✓ implementation of program and evaluation of results.

The risk management process starts with identification of risks, i.e. potential losses. For that purpose it is necessary to research the exposure of companies to property risks, liability risks, loss of income risks, loss of work capability risks, theft risks, etc. In order to identify risks, risk officers have several sources at their disposal such as previous experiences, various types of questionnaires and checklists, financial reports, conducted physical inspections, etc. Identification of risks

is followed by their evaluation, i.e. assessment of potential losses. This stage implies the establishing of loss occurrence frequency, i.e. probability of its occurrence in a specific time period. Besides this, it is necessary to determine the severity (gravity, impact) for each potential loss, i.e. to estimate a possible size of loss. On the basis of established frequency and “severity” of potential losses, they are ranked according to the importance for the risk management program. Moreover, a comprehensive risk management approach requires not only quantitative risk measures but qualitative evaluation of risk as well. Successful qualitative risk management, apart from consultations with experts, requires precise and clear risk management objectives, strategies and practices pervaded by established risk management culture. Accountability at each organizational level must be clearly defined and assigned. Furthermore, based on probability and level of identified potential loss, selection of the method for risk management is done. Methods for risk management are basically divided into methods for risk control and methods for risk financing. In the process, it is necessary to select one or combination of several methods, depending on the funds available for coverage of potential losses. After that, the implementation of the program of measures which need to be undertaken starts as well as the evaluation of results. For that purpose, we first need to give authority to the risk officers so they can implement the program without being disturbed. Also, it is important to inform all the company’s employees who will participate in the program on their obligations. For the purpose of better implementation of the program, it is necessary to conduct periodical controls and evaluations of program results, mainly due to potential changes of circumstances taken into consideration in the preparation of the program, and possible mistakes in the implementation of the program.

Large companies usually have specialized departments within their organizational structure whose main task is to collect information and make decisions in domain of risk management. Managers of these departments, *chief risk officers (CROs)*, are responsible for defining risk management policy by means of preparation of rulebooks for this business field as well as for making risk management information system. However, in order to successfully perform their duty, CROs should not act alone, i.e. they need to have full coordination with other business functions. In other words, in order to reach the company goals risk management departments must have full cooperation with finance, production and other business functions of the company. In doing so, the employees of risk management departments have to gather necessary information from other company departments, not only about pure, but also about other risks the company is exposed to.

Considering risk and uncertainty in the mining industry, Rendu (2000) emphasizes several key resources or fields that generate risks, as follows:

- ✓ management;
- ✓ geology and resource estimation;
- ✓ engineering design;
- ✓ cost estimation;
- ✓ environmental impact;
- ✓ revenue estimation and coal price;
- ✓ exploration, and
- ✓ political factors.

In the mining industry there are many factors affecting the likelihood and the consequences which cannot be expressed by numbers, and which need to be expressed by words (Tweedale & Joy 1997). For instance, the consequences of risks can be estimated in the following terms: (a) risks to people, i.e. the numbers of injuries of different severities; (b) risks to property and production, i.e. the monetary value of the damage or production lost; and (c) risks to the environment, the

extent of public reaction. Likelihood can be expressed in terms of the frequency per year, or the expected time between occurrences, e.g. 10 years.

Regarding the main types of risks to which the coal mining industry is exposed, we suggest the following taxonomy (Kozarević et al., 2013, pp. 806-807):

- ✓ strategic risks;
- ✓ managerial risks;
- ✓ operational risks;
- ✓ financial risks;
- ✓ market risks, and
- ✓ political, legal and social risks.

The basic research hypothesis is: "Based on the analysis of the current state of risk management in the coal industry of the F BiH, it is possible to identify the weaknesses whose elimination could significantly improve the risk management process and increase the level of economic protection for the companies within this industry".

### 3. A REVIEW OF PREVIOUS SURVEYS

Taking into consideration a number of relevant references, it appears that risk management in the coal industry has been the topic of research of many authors worldwide only in the last two decades or even less, regardless of the fact that risks are as old as coal operations in general. Chronologically, Tweedale and Joy's *Risk Management Handbook for the Mining Industry* (1997) gives information which may help coal mining companies' management, departmental personnel, and associated industries in the process of risk management. Because of the inherent hazards of mining as an activity and the complexity of mining machinery, equipment and the associated systems, procedures, and methods, the authors emphasized that it is not possible to be inherently safe. The principal responsibility for the safety of any particular mine and the

manner in which it is operated rest with the management of that mine.

Lind (2005) considered *Analysis of Pillar Extraction Potential (A-PEP)* as a convenient, intelligent tool, based on certain physical, risk, and economic factors, which could be used as a preliminary output indicator in consideration of the secondary extraction support pillars in the Witbank and Highveld coalfields of South Africa. Pillar extraction practices in South Africa have consumed a significant proportion of safety and fatality statistics in relation to its relative output and as a consequence the research was undertaken in local pillar extraction operations and extended to similar operation in New South Wales.

Grayson et al. (2006) found that during the period 1993-1999 no underground coal miners died from fires and explosions in the USA. A record low number of fatalities occurred in the coal industry in 2005 and the industry was poised to continue to make significant improvements. But in January 2006 and since then, three mine tragedies rocked the industry and coal industry fatalities rose to 37 through July of 2006 as compared to 22 in all 2005. As did many constituencies and Congress, *the National Mining Association* called for closer, independent scrutiny of the causes behind the fatalities and how the causes could be addressed and the fatalities prevented. The Association established *the Mine Safety Technology and Training Commission* to independently study the causes of events and fundamental issues that must be addressed in order to move the USA coal industry back into a global mine safety leadership role. Since its creation in March 2006, the Commission has studied the important events and issues. The study rang a clarion call for a new paradigm for ensuring safety in underground coal mining industry, one that focused on systematic and comprehensive risk management as the

foundation from which all life-safety efforts emanate.

Furthermore, Dunbar (2007) conducted a survey whose main purpose was to review the concepts of the descriptive viewpoint that would appear important to decision-making under uncertainty as well as risk assessment, management, and communication in the mining industry. Risk management is risk seeking or, more precisely, risk taking. The mining industry was generally tolerant of financial risks but essentially intolerant of risks involving safety.

In the same year, 2007, Komljenovic and Kecojevic illustrated historical data on the number of fatalities and injuries in surface coal, metal, and non-metal mining operations in the USA and described a systematic risk analysis process for occupational safety and health in the field. Hence, a review of published risk management and assessment applications for various industries was presented and a generalized approach to risk management for occupational safety and health in surface mining was proposed. The approach consisted of several phases, as follows: (1) development of a systematic risk analysis process; (2) establishment of guidelines for selection and implementation of risk assessment methods, and provision of models (templates) for selected methods; (3) characterization of hazards (frequency) and creation of an occupational safety and health hazard database for surface mining; (4) creation of a generic risk matrix for occupational safety and health; (5) development of a structured database for calculation of risk profiles and for facilitation of access and distribution of information, and (6) establishment of criteria for determining the acceptability of residual risks and for identifying unacceptable risks.

Underground coal mining has continually posed significant risks to worker safety and health throughout history. Looking back at the

coal mining disasters across the world (e.g. collapses, explosions, fires), Mischner and Rothfeld (2009) claimed it was clear that uniform global safety and health standards for coal mining are imperative. The coal mining was regulated regionally such as within the United States (*The Federal Mine Safety and Health Act of 1977*), the European Union (*The European Coal and Steel Community of 1951/52*), Australia (*The Coal Mining Safety and Health Act of 1999*), and China (*Labour Law of 1994/95*). However, these regional regulatory schemes are not equally effective or enforced and they have limited scope and numerous gaps. The authors asserted that the right of coal miners to safety and health protection is universal. They concluded that unless a coal mine safety and health international agency is established, coal miners around the world would continue to have their universal right to safety and health violated.

Cazzaniga et al. (2009) described various types and activities of the mining industry and also the main specialized machinery and equipment. They suggested that the industry is exposed to specific high hazards and risks and these were highlighted in detail for insurance underwriters' appreciation when dealing with the typical engineering insurance coverages for the mining industry.

## 4. METHODOLOGY AND RESULTS

### 4.1. Sample selection

In order to perceive the accurate situation related to the risk management processes in ten coal mines in F BiH, a primary research was conducted. A combination of research methods such as interview and survey was used, with a set of previously prepared and structured questions. The questionnaire was divided into nine sections (A-I, Table 4.1), and the survey participants provided answers to a series of questions related to various aspects of risk management. Most of the survey

questions were structured in such a way that the answers are scaled from 1 (the worst) to 5 (the best world practice). Also, some questions included more than one possible answer. Each question allowed for additional comments, observations or suggestions. Based on the same survey, factor analysis was done and key factors for efficiency of risk management in the coal mining industry were recognized (Kozarević et al., 2013, pp. 802-813), but this paper provides the results of descriptive analysis.

The analysis and gathering of the strategic risk management documentation was conducted for each research unit. Within each mining organization, according to its size and organizational structure, all relevant employees able to provide information on the current state, whose observations are important for evaluation of the entire risk management process (including management, control bodies, auditors, etc.), were invited to participate in the survey, ensuring the overall quality of the research sample.

### 4.2. Results of descriptive analysis and discussion

There were 121 valid survey responses in total. The survey questions were sent to all mining companies but the smallest organization in F BiH decided not to participate, which did not affect the quality of the data sample. The survey was analyzed using descriptive statistics and relied on relevant respondents' subjective perception of the risk management processes. Table 4.1 shows the summary of major indicators based on survey responses.

Table 4.1. Basic statistics for the risk management questionnaire

A – Risk management process	Mean	Standard deviation
To which extent the company, based on analysis, avoids risks?	3.60	0.98
To which extent the company takes precautionary measures for the purpose of risk prevention?	3.93	1.04
To which extent other methods of physical risk control are used?	3.76	1.05
To which extent the company consciously exposes itself to risks for which it has no protection system at all?	3.42	1.07
For the employees' personal risk management purposes the company uses insurance, e.g. accident insurance.	3.97	0.99
Risks related responsibilities of supervisory and executive staff in the production process are clearly defined.	3.82	0.87
B – Strategic risks	Mean	Standard deviation
The Risk Strategy is based on reliable information.	3.54	0.96
In strategic decision making the company considers risks indicated in the Risk Strategy.	3.42	1.29
The company's Risk Strategy is based on adequate analyses.	3.37	1.20
C – Managerial risks	Mean	Standard deviation
Organizational structure of the company is adapted to the risks the company is exposed to, i.e. it is organized in a way that allows efficient risk management?	3.51	0.83
There is an adequate communication between management and directly involved employees regarding risk-related information.	3.50	0.86
Risk management control system is clearly defined, supported by proper procedures and implemented according to the risks.	3.20	1.00
D – Operational risks	Mean	Standard deviation
To which extent safety and protection at work are defined by procedures/protocols resulting from risk assessment?	3.89	0.77
Identification and evaluation of risks related to safety at work is conducted regularly.	4.03	0.82
Reports on completed identification and evaluation of risks related to safety at work are regularly delivered to competent managers.	3.94	1.04
Company's environmental impact risks in a sense of ecological and other damages are evaluated and there is an adequate policy related to reduction of environmental impacts.	3.46	0.84
The rescue team (or the so-called "squad") continuously train and improve its capabilities.	4.08	0.98
The company has installed an information system that allows uninterrupted flow of information necessary for risk management.	3.17	1.16
The company has adequate and protected data bases created for risks information archive.	2.89	1.17
The company has defined procedures for reduction of strike and working operation interruption effects in order to maintain business continuity in crisis situations	3.01	1.21
The company is capable of business operating in conditions of weather disasters, for instance under heavy snowfall and low temperatures.	3.97	0.77
E – Financial risks	Mean	Standard deviation
The company has adequate procedures (an established control system) that can guarantee quick response to business irregularities generating financial losses (such as fraud, embezzlement, non-transparency, etc.).	3.53	0.85
The company is capable of identifying a wide spectrum of financial risks?	3.34	0.95
Risk management is an integral part of investment projects planning in terms of analysis of major risks to which the projects are exposed.	3.35	1.04
F – Market risks	Mean	Standard deviation
The company has an adequate response to competitor's new technologies.	3.04	1.07
The company is capable of identifying the risks related to sales function (for example, coal demand reduction).	3.45	1.09
The company is able to promptly identify the risks in the supply market.	3.27	0.93
The company is prepared to expand to the new markets based on production improvements.	3.14	1.00
The company has resources for mitigation of the effects of disruption in the economy (recession, stagnation, inflation trends, etc.).	2.50	1.00
G – Political, legal and social risks	Mean	Standard deviation
The company is capable of identifying the political environment changes which directly influence the business.	3.05	1.18
The company is prepared for an adequate response to social environment changes, such as protests in the region that can disrupt transportation of goods, vandalism, main business partners on strike, traffic blockade, etc.	2.86	1.08
The company is prepared to accept legal environment changes and has an opportunity to adapt to such changes (for instance, amended legislation).	3.52	0.96

H – Risk management resources	Mean	Standard deviation
The company has prepared an adequate budget for risk management projects.	1.95	1.08
All requirements for risk management integration into business process are met without introducing a new system of business process monitoring and reporting.	2.66	1.00
The company has the permanent research staff in charge of risk management, competent for adequate application of risk identification techniques, measurements, control and risk financing for the purpose of achieving the set goals.	2.34	1.08
The risk management process is implemented with great concern and pilot projects aiming to help in experience-based knowledge acquisition are introduced.	2.39	1.00
Awareness of employees about risk management and their attitudes towards the implementation of new techniques are changed, which improves the business process.	2.82	1.05
The company invests in technology that supports risk management, like reporting software, risks data base, etc.	2.74	1.10
I – Risk management implementation	Mean	Standard deviation
There is an understanding within the company that the costs related to risk management system development are justified in relation to the benefits brought by the system.	3.03	1.04
The company takes all necessary steps to inform its employees on risk management significance and the Risk Strategy.	3.00	1.11
The company conducts continuous staff training via its participation in seminars and workshops in the field of risk management (e.g. training for the ISO 31000:2009 standard).	2.83	1.15
The company uses the services of external (independent) experts in order to improve risk management and educate its staff for the work in this field.	2.74	1.12
How satisfied are you with risk management process effectiveness in your company?	3.02	0.84

Source: The authors' survey results

#### 4.2.1. Risk management process

Methods used by the mining companies in F BiH for risk identification are shown in Figure 4.1.

mostly based on various business reports, while more demanding risk identification techniques (questionnaires, interviews, flow charts, etc.) are rarely used.

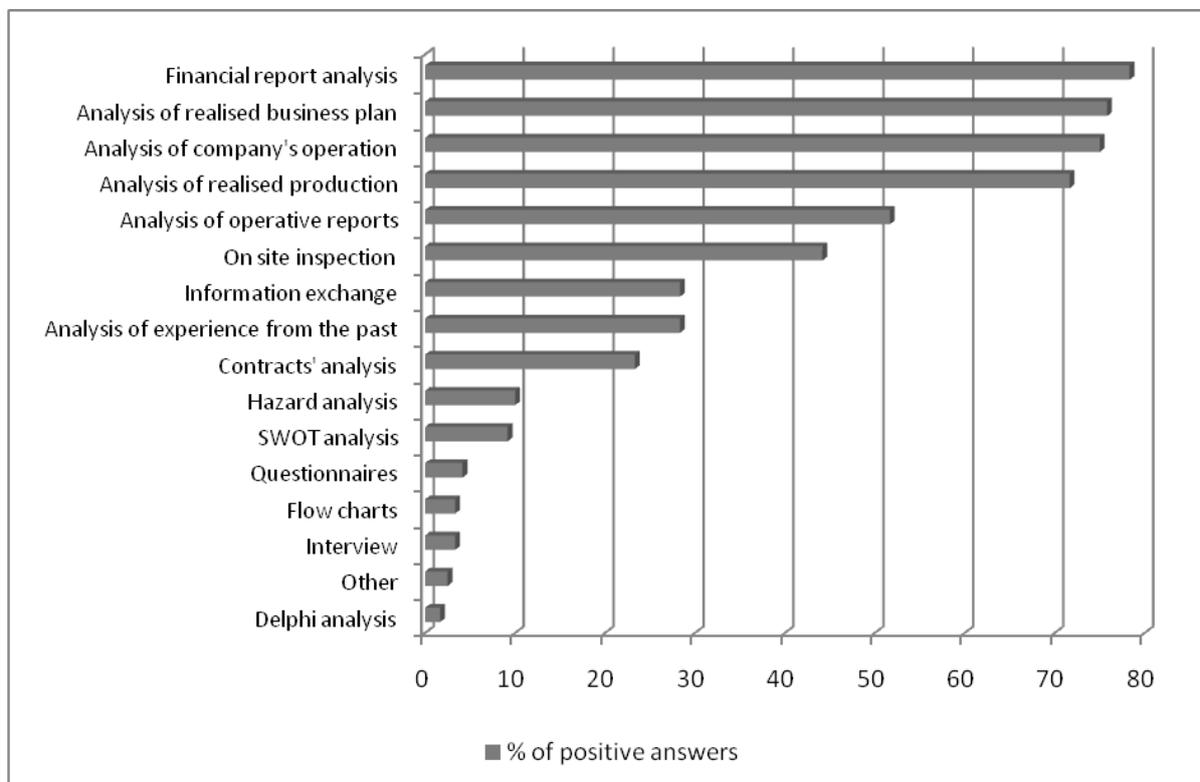


Figure 4.1. Risk identification methods in the mining companies of the F BiH

Obviously, risks are primarily considered as business risks and their identification is The risk measurement methods used in the mining companies are shown in Figure 4.2.

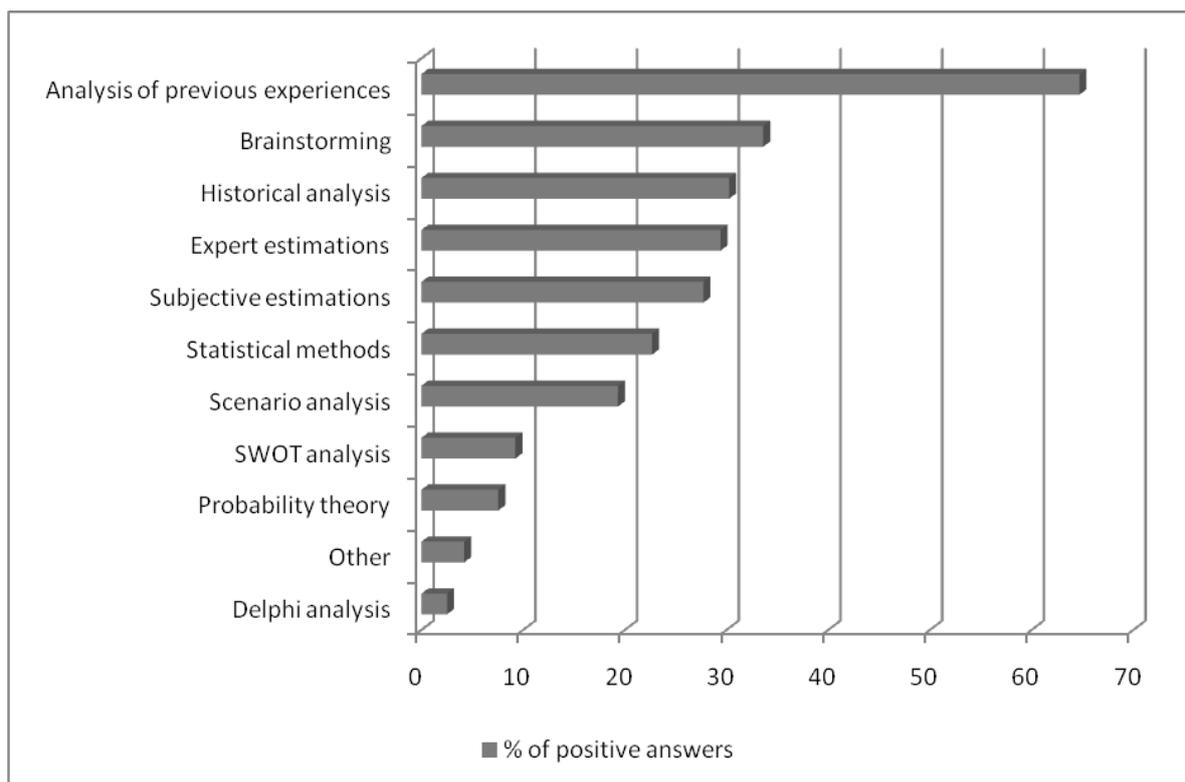


Figure 4.2. Risk measurement methods in the F BiH mining companies

Risk measurement is mostly based on the analysis of previous experiences, so there is a lack of more serious approaches that include application of statistical methods, probability theories, etc.

Based on the completed evaluation of risks in the mining companies, the following *risk management measures* can be taken:

- ✓ *Prevention* measures against the occurrence of accidents (installation of fire fighting systems, methane detection systems, video surveillance, security service, stock separation, etc.) – 80.17% positive answers.
- ✓ *Education of employees* that allows reduction of likelihood of accident occurrence (e.g. education in the fields of protection at work, rescue and firefighting) – 69.42% positive answers.
- ✓ Suppliers are required to provide *performance guarantees* – 61.98% positive answers.
- ✓ *Bank guarantees* are used for contracts for the supply of goods and services – 56.20% positive answers.

- ✓ Purchasing *insurance* (i.e. concluding appropriate insurance policies) – 29.75% positive answers.
- ✓ Contracts for the execution of works define supplier’s accountability for damages caused by such works (both material and injuries at work) – 24.79% positive answers.
- ✓ Establishing *capital reserves* for accidents – 13.22% positive answers, etc.

Basically, the above mentioned answers indicate that the most commonly used measures are preventive and educational, while certain types of guarantees are requested from business partners (supplier and bank guarantees). On the other hand, insurance as a risk financing method is marginalized, and capital reserves are rarely formed for accident cases, which is diametrically opposite to the financial firms’ method of operating.

The mining companies of the F BiH use the following instruments of *transfer of risk* to business partners:

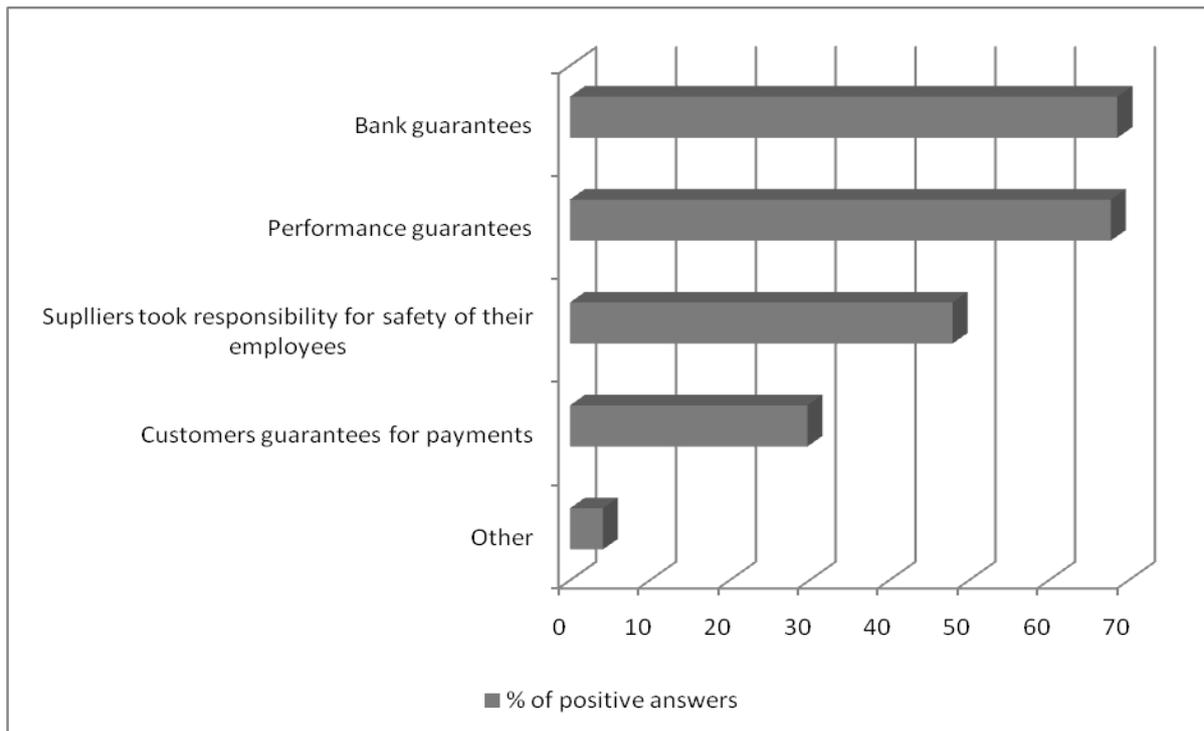


Figure 4.3. Risk transfer instruments in the F BiH mining companies

Therefore, the mining companies frequently use bank and performance guarantees as the instrument of transfer of risk to business partners.

Many *participants* are involved in the process of (active) risk management, as Figure 4.4 shows.

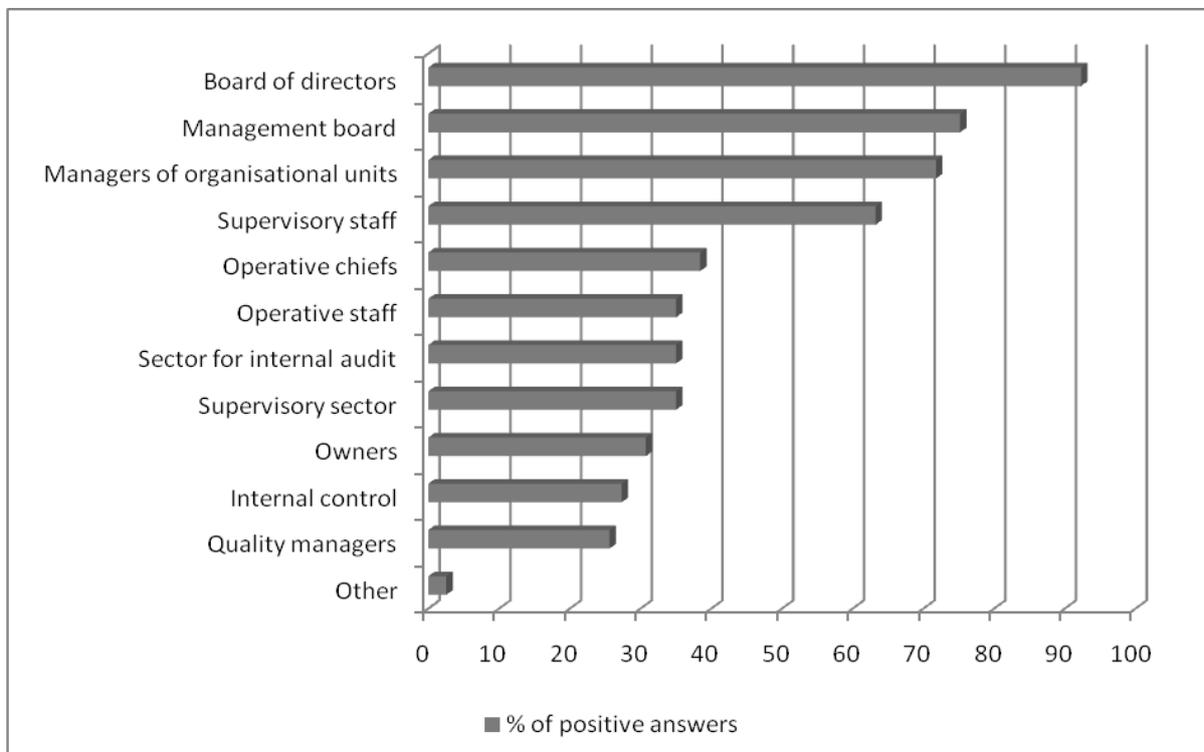


Figure 4.4. Participants in the risk management process in the F BiH mining companies

Apparently, different management departments and levels take care of risk management in the F BiH coal mining companies and, moreover, there is no systematic approach to this issue.

Risk management in the mining companies is organized in the following way:

- ✓ one person in charge of risk management (e.g. insurance administrator) – 5.93% positive answers;
- ✓ several employees (dealing with insurance affairs, occupational safety employees, security service, etc.) in charge of risk management – 89.83% positive answers, and
- ✓ other – 4.24% positive answers.

A number of 15.52% positive and 84.48% negative answers were given to the question whether or not a mining company has an organizational unit responsible for risk management. However, the issue of risk management is based on a fragmentary approach, so the insurance or occupational safety departments are seen as risk management organizational units, as provided by law.

#### 4.2.2. Strategic risks

Thirty per cent positive and 70.00% negative answers were given to the question whether or not a mining company has a legally stipulated document called the “Risk Strategy”. Practically, it means that most of the mining companies do not have an adopted “Risk Strategy”, despite the legal obligation to do so. The reason lies in non existing risk management departments in these mining companies.

The following participants are involved in the “Risk Strategy” development process, in those mining companies where such a strategy exists (Figure 4.5):

Therefore, the respondents’ opinions on the “Risk Strategy” are deeply divided. Besides, adoption of the strategy is not *de facto* based on a holistic (integral) approach nor does it recognize co-relations and mutual dependency among various risks to which the mining companies are exposed.

#### 4.2.3. Managerial risks

Slightly over half of the respondents (56.03%) believe that the mining companies’ organizational structure is adapted to the risks they are exposed to in their operation. Only 0.86% of the respondents think they are not adapted at all. The answers vary from very low adaptability (13.79%) to “not too low but insufficient” (24.14%) and “fully adapted” (5.17%).

Half of the respondents think that there is sufficient and adequate communication regarding information on risks between management and employees directly linked with such risks. Only 7,76% considers the communication completely adequate. Some 27.59% of the respondents think it is insufficient, and 13.79% estimate the communication is at a very low level. The number of those who claim that adequate communication between management and employees directly linked to risks does not exist at all is almost irrelevant (0.86%).

There is a wide range of answers regarding the control system in risk management (is it precisely defined, is it supported by appropriate procedures and implemented in proportion with the risks). Only 5.17% of the surveyed persons gave a completely affirmative answer, meaning the control mechanisms are in compliance with the leading world practices. A slightly smaller number of people (4.31%) offered an extremely negative answer, meaning the control functions are not defined at all, nor are they implemented in proportion with the risks.

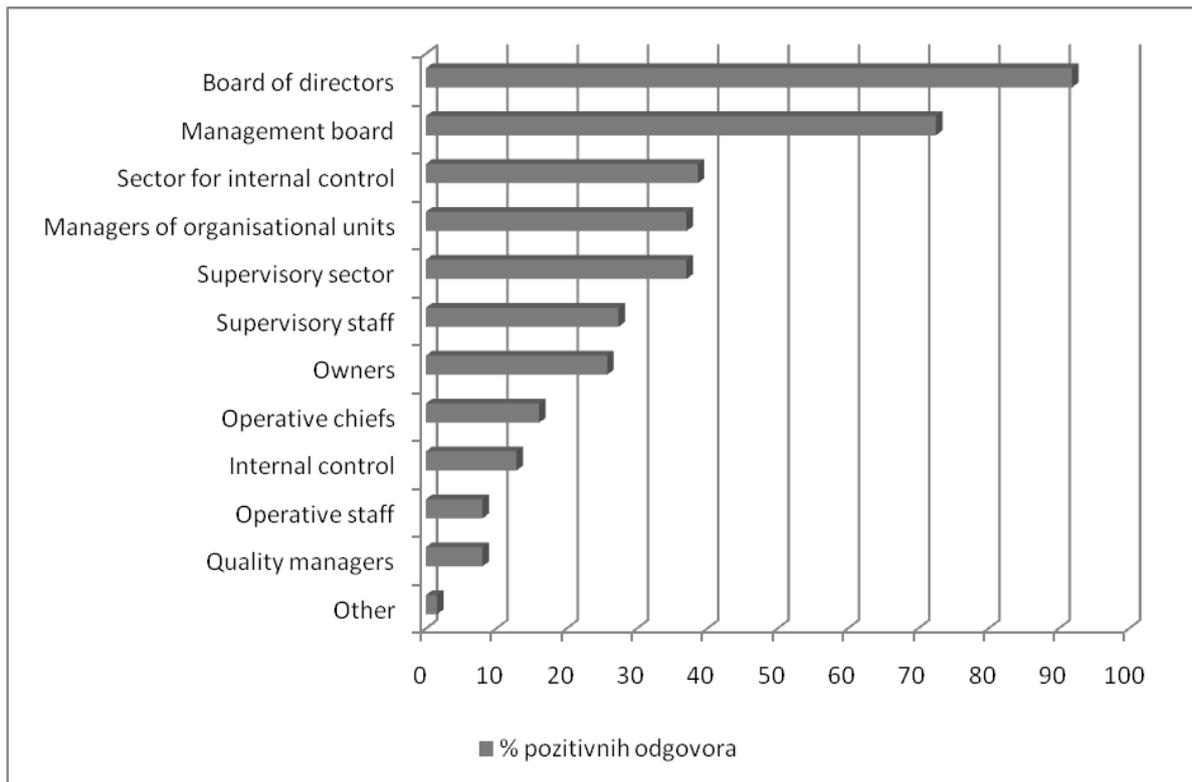


Figure 4.5. Participants in the "Risk Strategy" development in the F BiH mining companies

Some 23.28% believe the control system is barely defined; 25.86% think it is neither too little nor sufficiently defined, and 41.38% consider the control system sufficiently defined, supported by appropriate procedures, and implemented in proportion with the risks.

#### 4.2.4. Operational risks

A number of 4.13% of the surveyed persons think that safety and protection at work are barely defined by procedures/protocols based on risk assessments, 23.14% believe they are neither too little nor sufficiently defined, 52.07% think the procedures are sufficiently defined, and 20.66% think they are completely defined. Only a few mining companies are trying to define the procedures/protocols in the domains of risk management and protection at work through the introduction of ISO standards (ISO 9001:2008), while others mostly rely on the legally stipulated rulebooks.

Safety at work in mining companies is usually seen as a task of the occupational safety departments, as defined by the Law on Mining. Surveyed persons' opinions on the continuity of identification and evaluation of risks related to safety at work vary in a range of 16.67% of those who believe it is insufficient, 51.67% who see it as sufficient, and 28.33% that think it is done constantly. Only a small number of respondents (1.67% each) believe that permanent identification and evaluation of risks related to safety at work does not happen at all or is limited to a very small extent.

The question of whether the reports on identification and estimation of risks related to safety at work are continuously submitted to authorized officials was answered as follows: 35.54% believe it is done sufficiently, the same percentage (35.54%) think it is done completely, 19.83% claim it is neither rare nor sufficient, 5.79% think it is very rare, and 3.31% considers this task not being accomplished at all.

Regarding risk assessment of mining companies' impact on the environment and the implementation of adequate environmental impact reduction policies, 0.84% of the respondents think that such assessment and the policy are not implemented at all, 15.97% believe it is done very rarely, 23.53% think it is not so rare but is still insufficient, 55.6% believe it is done sufficiently, and only 4.20% consider it is done to the full. The risks of mining environmental impacts are formally dealt with through the communication with respective government bodies such as water management community; however, the level of protection in this area is apparently inadequate.

As many as 86.55% of the surveyed persons think the rescue team (squad) continually works on self-education and training (52.10% believe it is sufficient and 34.45% see it as to the full). The remaining respondents believe the team (squad) is trained very rarely or not constantly at all, and some of them think it is not so rare but is certainly insufficient (13.44 total respondents).

Although the existing information systems in the F BiH mining companies are used for other purposes, there is a possibility of their use for risk management as well. However, the adequacy of the existing information systems in a large number of mining companies is questionable due to the lack of proper software solutions. The existence of appropriate data protection, in the sense of risk databases in the F BiH mining companies is doubtful, and the situation is even more difficult due to evident obstructions among the employees.

It is very uncertain whether the mining companies do have appropriately defined procedures for reducing labor strike effects, which is partly caused by poor assessment of the management. In fact, there are defined procedures related to the maintenance or monitoring of mine cave safety parameters

(gas parameters, water level, condition of mining premises, etc.) in underground excavations. The analysis of answers to this question shows that mine cave exploitation in the F BiH coal industry is able to function under bad weather conditions, which is not the case with open-pit exploitation (landslides, water inflow, etc.).

#### 4.2.5. Financial risks

The F BiH coal mining companies have established a financial control system based on the following measures:

- ✓ Control of cash dealings is performed (control of payments, finance papers, special inventories, etc.) – 94.02% positive answers.
- ✓ Control of cash flows is performed (control of financial transfers, control of modes of payment, etc.) – 88.03% positive answers.
- ✓ There is an established system of minimum, maximum and optimum stocks – 22.22% positive answers.
- ✓ There is a control of product and material flows within the company – 80.34% positive answers.
- ✓ The stocks are properly stored, preventing financial losses due to accident occurrence – 47.86% positive answers.
- ✓ Estimation of the property value is conducted, indicating that way its real value – 46.15% positive answers.
- ✓ Estimation of the buyers' solvency is performed and further business activities are based on such assessment – 32.48% positive answers.
- ✓ None of the above mentioned – 3.42% positive answers.

While 7.63% of the respondents consider that the mining companies fully apply adequate procedures that can ensure rapid reaction towards the irregularities in business operation causing financial losses, 52.54% believe that such procedures are applied to a

satisfactory extent. Some 27.12% think the procedures exist but insufficiently, 11.02% believe they are at a very low level, and 1.69% claim the procedures do not exist at all.

Only 2.56% of the surveyed persons think that changes of the exchange rates, interest rates, suppliers' position on the market, prices of products and services required for uninterrupted business functioning are not observed by the mining companies at all; 18.80% think they exist but at a very low level; 27.35% see them as existing but still insufficient; 44.44% believe that such changes are observed sufficiently, and 6.84% believe that companies completely observe these changes.

Only 10.26% of the respondents think the mining companies absolutely take risk management into account in the investment-project administration. Most of them (41.03%) believe that risk management is an integral part of the investment project development in terms of evaluation of risks for the projects at a satisfactory level. Some 27.35%, 16.24% and 5.13% of the respondents think risks are an integral part of the mining companies' investment projects insufficiently, at a low level, or not at all, respectively.

#### 4.2.6. Market risks

Since most of the mining companies belong to JP Elektroprivreda BiH dd. Sarajevo (Public Enterprise Electric Utility of BiH), investment planning is done at the corporation level. However, the mining companies clearly do not have an entire or at least adequate response to the introduction of new technologies by the competition.

Coal demand planning for different periods (annual or three-year plan) is also done at the corporation level. A number of 14.29% of the surveyed persons think the mining companies of the F BiH are fully capable of identifying the risks related to sales function (such as

reduced coal demand), 43.70% believe the risk identification capability is at a satisfactory level, 20.17% see it as not too low but still insufficient, 16.81% judge it to be at a very low level, and 5.04% think that such capability does not exist at all.

Accordingly, 5.13% of the respondents consider the mining companies fully capable of prompt identification of risks in the supply market, 41.88% believe such capability is sufficient, 31.62% think it is not too low but is still insufficient, 17.95% believe it is at a low level, and 3.42% think it does not exist at all.

The mining companies can place the existing production to current customers but there is an obvious need for reconstruction in order to increase the volume of production and, consequently, to expand into new markets. Continued demand, competitive production, and coal prices are seen by mining companies as the best answer to the impacts of economic disturbances, such as recession, stagnation, inflation tendencies, etc.

#### 4.2.7. Political, legal and social risks

The respondents in general do not believe that the mining companies are ready to identify future changes of the political environment which directly affect their operation (only 12.50% think the mining companies' responsiveness is in line with the leading world practices, while the remaining answers are widely dispersed).

The mining companies are not considerably prepared to react adequately to the changes in social environment, such as traffic blockades, rally, labor strikes, etc.

The answers related to legal changes also point out mining companies' general incapability to anticipate possible legislative changes and find appropriate practical solutions.

#### 4.2.8. Risk management resources

Apparently, the most difficult situation is related to the budget for risk management projects, commonly deriving from unawareness of this aspect in the mining companies operation.

Based on the acquired replies, we can conclude that requirements for risk management integration into the business process are not met, since such an action requires a higher level of coordination between management and production, meaning between the work environment in a mining cave and top management.

Basically, the mining companies do not have the permanent research staff in charge of risk management, and these tasks are mostly seen as a responsibility of the internal audit division, audit board, and management. There is a shocking detail of 21.01% of the respondents who believe the risk management process is not implemented with proper attention at all, and there are no pilot projects which should facilitate acquisition of experience-based knowledge.

The remarks related to the level of employees' awareness of risk management and their attitude towards the introduction of new techniques that improve business operations are disturbing, which is a consequence of insufficient education and investments into development of the general risk management culture.

Despite the modest level of investments in information technologies, those activities are led from the corporation level as well, so the acquisition of software is considered to be the final stage of operations rather than basis for development of the risk management process.

#### 4.2.9. Risk management implementation

Only 4.35% of the respondents believe the mining companies are fully aware of

justifiability of risk management system development expenses in regard to the benefits provided by the system. Some 33.91% think that such awareness is at a satisfactory level, 29.57% believe the mining companies insufficiently understand that such expenses are justified because of the benefits, 24.35% consider the level of awareness very low, and 7.93% believe the mining companies do not comprehend these relations at all.

As a general rule, the mining companies do not undertake all the necessary steps to inform their employees on the significance of risk management and the "Risk Strategy". Clearly, the F BiH mining companies in general are not sufficiently focused on permanent employee education in the field of risk management, such as ISO 31000:2009 standard. Only 4.17% of the respondents draw level of the practice of the existing mining companies with the leading world practices in the field, with the average rating of 2.83. Also, the average rating of independent external risk management experts hired by the mining companies is relatively low, only 2.74. The reason lies in general impression of the most of respondents (79.49%) who believe that such engagement are insufficient, at a very low level, or do not exist at all.

Most of the surveyed persons are not satisfied with the effectiveness of the risk management process within the mining companies (70.08%).

### 5. CONCLUDING REMARKS AND RECOMMENDATIONS

Based on the above mentioned, we can conclude that the general research hypothesis is confirmed. This means that the analysis of the existing situation in the field of risk management in the F BiH coal mining industry allows the identification of weaknesses. Their elimination could significantly improve the risk management process and increase the

level of economic protection in these companies. To be precise, as large companies or companies highly exposed to risks (particularly pure risks), the mining companies should be a model for other BiH commercial entities in the sense of risk management approach. Of course, we cannot say that mining companies neglect the issue; however it is still far from a systematic (holistic) approach necessary for achieving the best possible results. It is most visible in the stages of identification and evaluation of risks, which are still based on some basic techniques, without getting into a more serious analysis. Prevention is the most important among risk management techniques due to the specific risks in coal mining industry. Regarding risk financing methods, the main weakness lies in excessive risk retention without previously prepared reserve funds for these purposes. The implementation of the risk management program is another specific problem because neither organization nor accountability related to risk management in mining companies has been resolved adequately.

The fact that most of the mining companies do not have a legally stipulated act - the "Risk Strategy" - that should serve as a legal framework for risk management regulation clearly illustrates the approach of mining companies' managements to systematic risk management. And for the mining companies that have developed such a document, it is questionable whether it was based on a serious analysis and to which extent it has been used as a risk management framework.

The existing organizational structure of the mining companies is not entirely adapted to the risks they are exposed to, which makes risk management even more difficult. This is particularly evident in vertical communication which does not allow an adequate exchange of information, which is crucial for the effective risk management process. The control system

in risk management has been neither fully defined nor supported by proper procedures.

A great deal of consideration is dedicated to operational risks, which makes a positive side of the current risk management in mining companies. Therefore, the procedures related to safety and protection at work, identification and measuring of occupational risks, exchange of information in this field, education and training of rescue teams, as well as readiness to work under bad weather conditions are highly rated. The situation regarding the environmental risks is not so good, as well as the risks related to adequacy and safety of the existing information systems.

The financial risk management in the mining companies is based on classic financial control techniques and procedures that are not completely reliable in terms of a rapid reaction to irregularities in business operations, which can cause financial losses. In the sense of market risks, the mining companies show less "fear" from the risks related to product sales, which is logical bearing in mind the high level of coal demand. On the other hand, the risks related to competitors' introduction of new technologies, risks in the supply market, risks related to the expansion into new markets, and particularly the risks related to economic disturbances require significant improvements in the field of risk management. A similar situation is with political, legal and social risks.

The risk management resources and implementation are the main obstacles and require important improvements. Apparently, the budget for risk management projects is inadequate, requirements for risk management integration into a business process are not met. There are no researches in the field of risk management, risk management awareness among the employees changes slowly, and there are no investments in new technologies which would

upgrade the process. The external (independent) experts' services for education of employees and improvement of the risk management process are insufficiently used. Therefore, the general level of satisfaction in terms of risk management efficiency is not so high.

Finally, the following steps and/or activities for improvement of the risk management process in mining companies may be recommended:

- ✓ Reorganize the mining companies in a way that allows urgent formation of a separate organizational unit (division) with the focus on risk management and link it with internal audit and quality management system, which is still developing and should be completed in compliance with ISO 9001:2008 requirements. As an alternative, a special team, composed of the existing employees with relevant skills, could be formed and deal with risk detection, improvement and management system.
- ✓ One of the key activities of the mining companies in the improvement of the risk management process is creation of the strategy (including a vision, mission, strategic goal and strategy itself) and its effective implementation.
- ✓ Establish a comprehensive risk management process comprised of risk identification, evaluation, adequate treatment ("mitigation"), monitoring and control.
- ✓ Focus on mining company's internal controls, which must be regular and comprehensive, and precisely define the rules for such controls. The supervision over the internal control system should also be established and maintained.
- ✓ Risk management itself should be based on the following principles: contribution in creating surplus value, participation/contribution in decision making, explicit addressing insecurity;

systematic, structured and timely manner; organization based on information availability, adaptability, etc.

- ✓ Establish a single information system for all business locations of a mining company, GPS tracking for coal transportation, and more efficient system of distribution and transfer of documents within a company, as well as increase the level of risk information.
- ✓ Adopt a set of actions for technical and economic improvement of risk management in the coal mining industry.
- ✓ Apply certain improvements in the processes of machinery and/or device manipulation, upgrade preventive maintenance of the machines, conduct regular equipment maintenance, increase the investment maintenance, etc.
- ✓ Risk management process improvements also include primary as well as permanent additional education of employees in the sense of increased individual risk awareness.
- ✓ In order to intensify business efficiency, a quality aspect must be incorporated in the risk management process as well, meaning it should become an integral part of the organizational culture.

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