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A Knowledge Management Framework as Knowledge Bases Development Support to Professional Risk Assessment in SMEs

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1. Introduction

The market situation of the European countries is the following: 99% of companies in the EU are small and medium sized enterprises (SMEs) – companies with a maximum of 250 employees and a maximal turnover of € 50 million. In the European Union (Europe have 23 million SMEs and 41 000 large companies) SMEs employ more than 65% of all employees. During past years, SMEs have created 80 % of the new jobs in the EU (IP/08/1003, Brussels, 25th June 2008). SMEs meet the multiple economic, technical and social functions, such as:

- Generate the greater part of GDP in each country, usually between 55% - 95%;
- Provide jobs for majority of employment;
- Produce a large percentage of the applicable technical innovations in the economy;
- Have the highest market dynamism in the economy, a situation evidenced by the evolution of their number, the volume of turnover and size of employment, higher sensitivity to large companies;
- Produce products and services at lower costs than large companies, the main factor causing this difference are lower costs;
- Show high flexibility and adaptability to market requirements and changes favored by smaller size, faster decision-making process, specifically the entrepreneur and his direct involvement in ongoing activities;
- Are the seeds for future large firms, particularly in new areas of the economy, etc.

The SMEs research development activities, products development, new technologies implementation (see figure 1) presupposes knowledge and assumption of multiple risks. As a result of a new product development paradigm, there is a greater need for software tools to risk estimation.

The risk evaluation sustains SMEs in the uncertainties elimination in the development strategy and management policies (see figure 2).

Estimation, evaluation and control of the occupational risk represent prerequisites for grounding and for a continual support of the decision that has been previously taken on occupational safety in a working system (Vasilescu et al., 2008; Tint et al., 2009).

However, in the last time, a lot of research in the field of knowledge management is dedicated to large companies or international concerns and the small and medium-sized

enterprises were forgotten. This is the main reason why in this paper analyze the SMEs knowledge and knowledge management, the risk management process and the professional risk assessment as essential part of SMEs business, the knowledge bases built and use to assess the risk at the SMEs level.

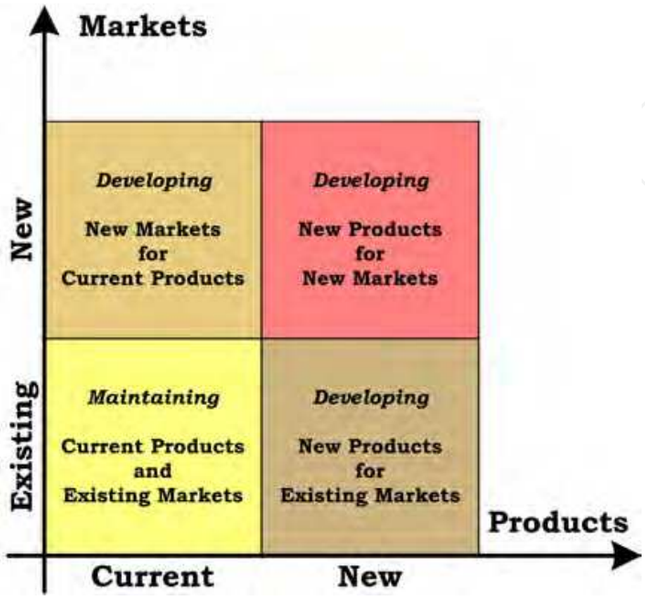

Fig. 1. The SMEs market strategy matrix

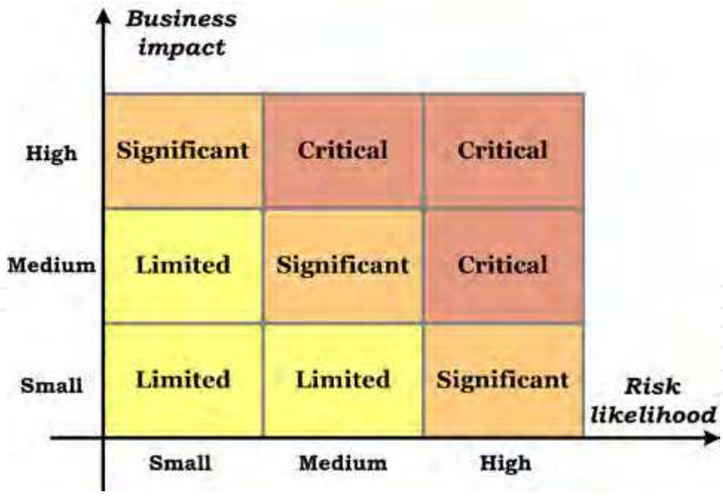

Fig. 2. The SMEs risk assessment matrix

The SMEs product development process has become an intensive process of knowledge application and it consists of a process of transformation of information. The knowledge creation is the major resource of organizational innovation and it, therefore, plays a more crucial role in developing a sustained competitive advantage for organizations, especially in a dynamic environment (Huang, 2009). The business advantage in having knowledge application, lies in the ability to analyze large amounts of data from any business model,

determine the personalized preferences of all potentially customers, than rich them with relevant information, wherever they may be (Dragoi et al., 2010). Nowadays, enterprises tend to differentiate themselves from what they know (intellectual capital) and from how they use knowledge. The interest for knowledge within enterprises begins with identification that the value of market of several enterprises is much larger than the value of their own physical patrimony (equipments, facilities etc.) (Rosu et al., 2010b).

2. The SMEs knowledge

Knowledge is power and knowledge has value, but knowledge value is still a challenging topic that has not been completely clarified, whether it be in engineering science or philosophy, economics, etc. (Xu and Bernard, 2011). Over the past 15 years, knowledge management (KM) has progressed from an emergent concept to an increasingly common function in business organizations (Zach et al., 2009). Understanding knowledge management within SMEs is fundamental to economic advancement, particularly if priorities and practices transferred from large organizations are sub-optimal or counter-productive (Sparrow, 2011). Knowledge exists in the mind of people and circulates within organizations (Nonaka and Takeuchi, 1995). For all companies KM and innovation plays an important role (Porter, 2001). Many of KM initiatives are implemented in large companies but in the last years there is a shift towards small and medium-sized enterprises (Fink and Ploder, 2006). Lately, there is increasing realization of need and significance of KM for sustainable competitiveness for SMEs (Pillania, 2008). According to some studies SMEs need a simple framework to organize their key knowledge processes: knowledge identification, knowledge acquisition, knowledge distribution and knowledge preservation (Fink & Ploder, 2007; Ploder & Fink, 2007). The *key knowledge processes* (KKPs) for SMEs (Rosu et al., 2009b) identified (presented in figure 3) are:

- *Knowledge identification* - this process consist in identifying a collection of data, information, text, technical documentation, laws, standards, questionnaires, etc.., thus covering all the basics in a certain area.
- *Knowledge acquisition* - represents the transfer of knowledge from a source of knowledge (e.g. experts, documents, procedures) at a warehouse of knowledge (e.g. organizational memory, intranet, documentation, etc.).
- *Knowledge evaluation* - referring to the interpretation of the acquired knowledge using the techniques, methods and measuring instruments developed in accordance with the objectives and type of assessment, depending on the content and intended purpose, the purpose of issuing value judgments that underlie a particular decision.
- *Knowledge structured* - involves knowledge organization and classification in order to rapid retrieve and complete.
- *Knowledge combination* - should be viewed as a combination (union, alignment) to separate knowledge in order to increase their value.
- *Knowledge shared* - is the process by which knowledge is exchanged (distributed) within the organization.
- *Knowledge utilization* – means the use of scientific and technical knowledge to decision makers and by other members of the organizations in professional practices.
- *Knowledge preservation* – is a process of storage (preservation) of knowledge over time safely to be accessed in the future.

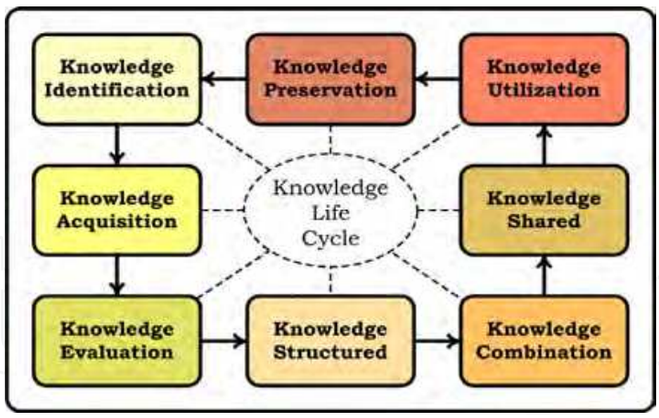

Fig. 3. The *key knowledge processes* (KKPs) for SMEs

Knowledge discovery is widely acknowledged as an interactive and iterative multi-step process ranging from the development of business understanding, data understanding, data preparation, modeling, evaluation and ultimately deployment (consolidation) of discovered knowledge (Sharma and Osei-Bryson, 2010). For SMEs it's necessary that the advantages of KM are clear and the implementation is easy otherwise they will continue to focus on their traditional way of working (Nunes et al., 2006). There are four different roles of knowledge in SMEs business (Fink, 2000; Heinrich & Lehner, 2005):

- *Knowledge as support*: there is a low current strategic position of knowledge and in future too.
- *Knowledge as manufactory*: knowledge plays now an important role but the importance will decrease in future.
- *Knowledge as breakthrough*: in future knowledge will play a very important role for the business still it does not.
- *Knowledge as weapon*: knowledge is important and the importance will increase in future.

Generally, in some SMEs activity sectors, the knowledge generate capacity exceeds the human records and process capacity, which lead to a super sized knowledge offer. In this way can be generated an inefficacy at the organizational and personal level.

Figure 4 shows the relationship among knowledge production, knowledge assimilated and the knowledge uses effect. This figure reflects the three essential trends that characterize the new knowledge society and can influence some SMEs activities (Rosu et al., 2009b):

- Knowledge offer increase;
- Knowledge assimilated increase, but in a much slow rhythm;
- Maintaining an almost constant level for knowledge used.

Short, medium and long term knowledge in handling industrial purposes research will focus on three main directions:

- *Knowledge capitalization;*
- *Knowledge formalization;*
- *Knowledge use.*

The main studies are identified two important distinctions of types of knowledge that has been used (Dragoi et al., 2007; Rosu et al., 2009a, 2009b; Rosu et al., 2010b):

- *The explicit knowledge* – which can be expressed in words and numbers; they can easily be communicated and distributed in the form of data, scientific formulas, codified procedures or universal principles.

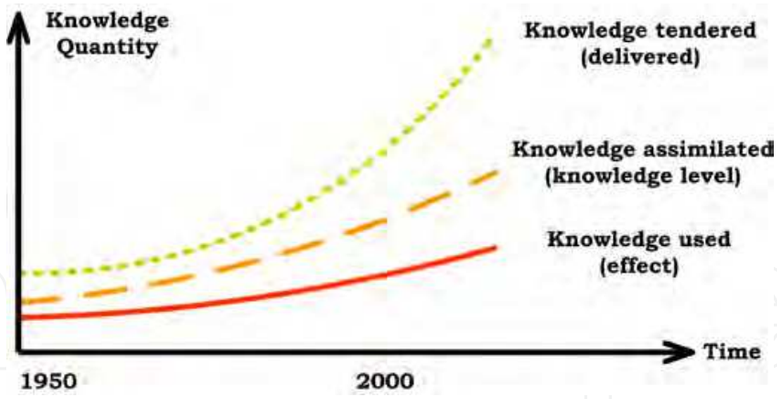

Fig. 4. *Knowledge flow* vs. *knowledge used* in SMEs (Rosu et al., 2009b)

- *The tacit knowledge* – that are very personal and difficult to formalized, dependent on experience and individual characteristics.
- *The implicit knowledge* – stored in the entities that depend on the practical context – products, technologies, processes, etc.; the value of knowledge is manifested in physical goods and services, the intellectual products (patents and licenses), processes (structural capital) and people (intellectual capital).

Enterprises are getting more knowledge intensive, and the integration of various types of knowledge becomes a challenge (Huang, 2008). Success of an enterprise is increasingly dependent on its capability to create an environment in order to improve productivity of knowledge work (Maier et al., 2009). At the enterprise level the knowledge could be found to individual, group or external resources. Professional qualifications, personal experiences, capacity to transform information's in knowledge constitute the individual resources. Patent acts, models, concepts, enterprise culture and management form the group resources. Individual and group resources totality represents the enterprise internal resources. Relations set of external resources with client, suppliers and partners, product and services credibility, offering quality. Tacit or explicit knowledge transfer between these resources

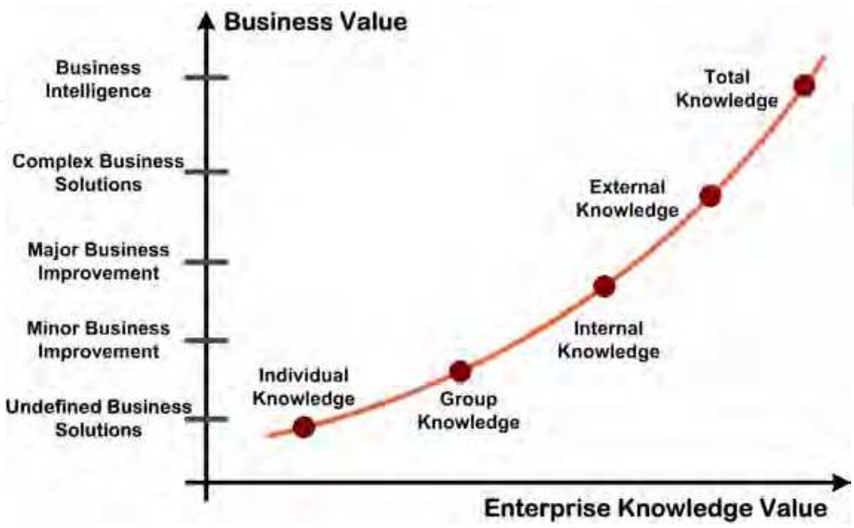

Fig. 5. *Business value* vs. *knowledge value* in SMEs (Rosu et al., 2010b)

and knowledge conversion from a resource to other determines value creation (Rosu et al, 2009a, 2009b). Knowledge from internal and external sources may be categorized into functional or general domain knowledge, organizational knowledge, and problem-specific knowledge (Bolloju et al., 2002). Figure 5 shows how business value is added when the volume and quality of knowledge from the company grows.

The knowledge of employees of an organization is an important asset and such knowledge should be garnered for the ultimate good of the company (Hussain et al., 2010). At the enterprise level knowledge that employees have or should have are varied (see in figure 6 the *key knowledge employees* - KKEs) and can be classified as follows:

- *General Knowledge* - refers to knowledge's that are so popular that would be known by everyone or nearly everyone. The term "general knowledge" is used in everyday conversation (e.g. how good is your general knowledge level?). Another term that could equally well define this type of knowledge might be *Common Knowledge*. Because these skills are widely known would be to restrict general/common knowledge relatively few things taking into account the diversity and geographical distribution of the enterprises. General knowledge doesn't mean special, specialized or specific knowledge. The general/common knowledge is usually limited within certain boundaries (e.g. the general knowledge in a Romanian enterprise are different from general knowledge in a Brazilian company). Commonly, companies require employees with a good level of general knowledge since their recruitment.
- *Commonsense Knowledge* - is a collection of facts and information that an employee is expected to know, which means different people know different things. Common sense refers on the one hand to knowledge and, on the other hand, to solve problems using reasoning skills. Commonsense refers to the everyday knowledge such as to know that every day at work, morning, read the e-mail. Enterprise commonsense knowledge refers to things that an employee has to know just to be able to integrate and work within an enterprise. Employees of different companies may have different commonsense knowledge.
- *Organization Knowledge* - the organization knowledge (*Enterprise Knowledge*) means capitalizing (using information and communications technologies) knowledge employees (knowledge is made jointly). The aim is to build the best alternative use of resources that the enterprise has according to objectives and which, due to internal and external organization developments will be adjusted dynamically. At the enterprise level, employees involved in all activities must be a team and to combine the knowledge and skills for their work to become efficiently.
- *Acquired knowledge* - are the result of a complex process of collection (by the enterprise employees) information and knowledge necessary to develop and improve the activity (in the area in which they work) and problem-solving process. The result of the knowledge acquisition by employees consists of a lot of information and knowledge unordered. This knowledge and information will be selected, analyzed and interpreted by employees during the learning process.
- *Learned Knowledge* - in the enterprise, learning is a process of documentation, experimentation, analysis and interpretation, a process of sharing the knowledge generated by employees in the past. Learning is a process of permanent change, transformation and updating of knowledge resulting in improved ways of thinking and action of employees. An enterprise is more successful if its employees learn quicker, implement and commercialize knowledge faster than the employees of competitors.

The learning knowledge process should receive special attention and organizational structure and culture of the enterprise should stimulate this process in order to improve production by obtaining relevant results in all activities.

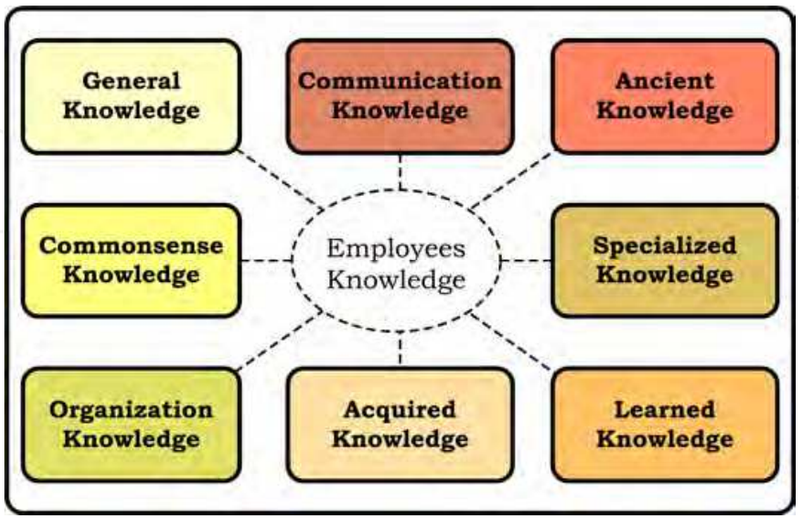

Fig. 6. The *key knowledge employees* (KKEs) in SMEs

- *Specialized Knowledge* - specialized employees knowledge refer to the detailed understanding of enterprise products and services and national and international markets for these products and services, as well as advanced knowledge about enterprise processes and procedures.
- *Ancient Knowledge* - knowledge that is possessed only older employees or employees who have retired. There are cases in which this knowledge has disappeared (and must be recreated) because the documentation doesn't exist or hasn't been adapted by experts or employees haven't shared before they retire. In these cases, enterprises may use the older or retired employees as consultants (for them to outsource their old or lost knowledge).
- *Communication Knowledge* - knowledge about how can be shared knowledge from one employee to another employee or group of employees in the enterprise collaboration and cooperation processes.

In SMEs knowledge can be capitalized (see figure 7) through (Rosu et al., 2009a):

- *Gathering data, information and knowledge from customers, providers and partners:* collecting all data, information, knowledge from clients into a knowledge base; using the info on customers for product and services development and modernization purposes; tight connections with customers through the Internet - maybe opening a forum for discussions; a thorough recording of the staff's contacts with the customers, of customers' wants for anticipations in the future.
- *Creating new incomes by exploiting the existing knowledge:* keeping all patents, licenses, market and necessity research, technical and economic research in a database accessible to the personnel; in case of changing profile within the company into a similar one: keeping all methods and expertise acquired during the former one; selling knowledge/expertise to other companies by means of license, patent, consultancy, etc.

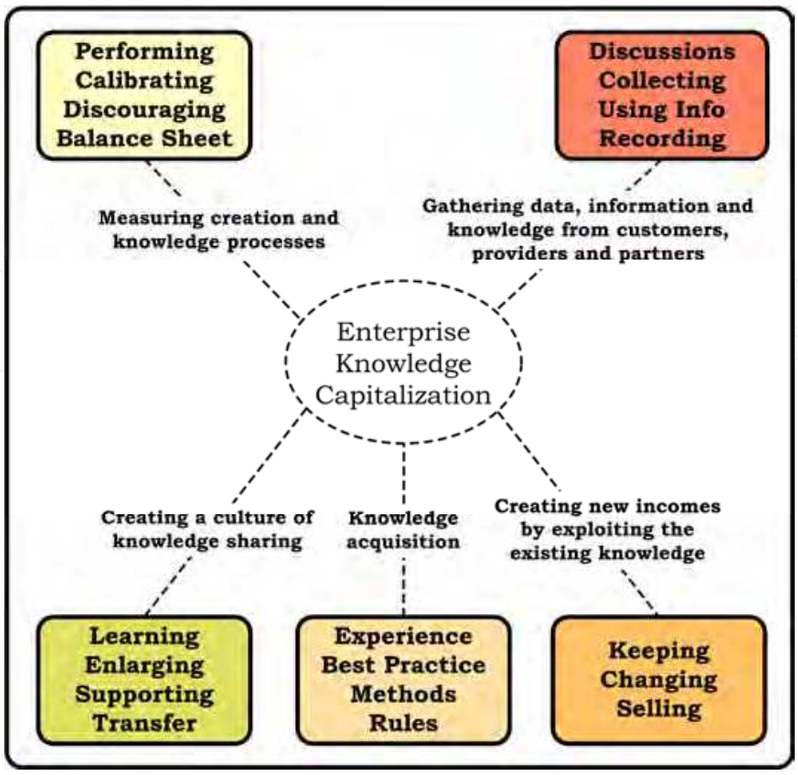

Fig. 7. The key knowledge capitalization processes (KCPs) in SMEs

- *Creating a culture of knowledge sharing:* encouraging learning and improvement; supporting those failing their attempts; upholding a competitive environment and rewarding personal initiative; creating a culture of knowledge sharing from the top of the organization to all its lower levels; enlarging people's knowledge area beyond their field of expertise; setting goals to employees; creating environment for knowledge transfer - such as teamwork, meant especially for knowledge and info transfer from experts to newly employ.
- *Knowledge acquisition:* keeping all experience gained in every (previous) activity in a knowledge or database; creating a knowledge database comprising the best practice, methods, rules and facilitating communication through e-mail, videoconference, Internet forum, etc.; rewarding employees having good results in the acquisition and accumulation process; equal male and female employment, as well as of foreigners; diversity and multicultural representation lead to creativity.
- *Measuring creation and knowledge processes:* performing a knowledge quality audit; calibrating customers, providers and partners according to the value of their contribution to the knowledge process; annual balance-sheet including profit and loss in HR terms and a balance of HR investments; discouraging the use of financial indices in management and mainly in knowledge management.

3. The SMEs knowledge management

Knowledge management (KM) is the process that is organization and coordination of knowledge from the knowledge of the organization. KM is the set of processes that seeks to

change the organization's present pattern of knowledge processing to enhance both it and its outcomes (Firestone and McElroy, 2005). Knowledge processes supported by knowledge infrastructures improve individual and team creativity and facilitate innovation (Janev and Vranes, 2005). The processing-driven paradigm of KM has its focus on best practices, training and learning programs, cultural change, collaboration, and virtual organizations (Malhotra, 2005).

The KM processes involves (see in figure 8 the *key knowledge management processes* - KKMPs) (Rosu et al., 2010b):

- *Knowledge clustering* – the kinds of knowledge from the sources of the organization, the processes up to formation of internal memory.
- *Knowledge storage* – this aims to store knowledge in the knowledge infrastructure of the organization, in terms of efficiency.
- *Knowledge classified* – for evaluating and granting priorities that reflect the quality of knowledge and the adequacy requirements processes.
- *Knowledge selection* – this allows the user to use certain criteria for identifying the most appropriate knowledge.
- *Knowledge dissemination* – that knowledge stored in various forms (tacit, explicit or implicit) are accessed by all members of the organization and even stakeholders – customers, suppliers, etc.

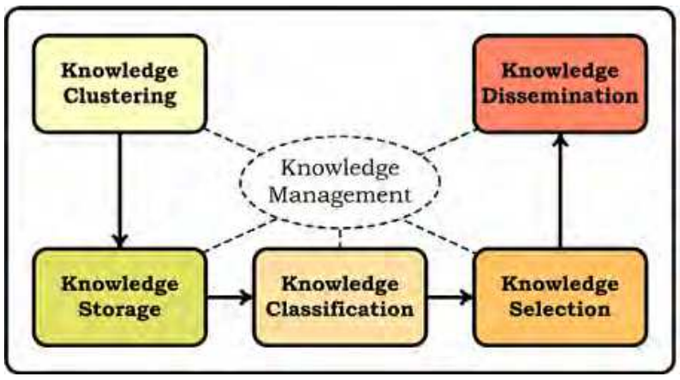

Fig. 8. The key knowledge management processes (KKMPs) in SMEs

Successful SMEs are those who can leverage their knowledge in an effective and efficient manner, so as to make up for deficiencies in traditional resources, like land, labor, and capital (Desouza and Awazu, 2006).The knowledge of the enterprise contains the sharing knowledge of each individual (Dragoi et al., 2007; 2010). For increase the knowledge in SMEs for an efficient management of the intellectual capital and to improve the business value, we proposes a KM scenario in eleven steps: obtains and uses, learn and contribute, evaluates, sustain, support, exchange, combination, transfer,preservation, recovery and discharge (see figure 9), (Rosu et al., 2008, 2009a, 2009b):

1. *The step obtains and use* is well known within organizations. People always seek information and use them later to solve their problems, to take decisions or to create new products. Therefore, new technologies (e.g. Intranet/Internet/Extranet) allow that the large amount of information that flows within organizations can be correctly managed.
2. *The step learn and contribute* are relatively new for organizations. For example, it has been difficult to convince employees to contribute to the organization's knowledge

base. New technologies have helped companies easily organize, send and transfer certain types of information. However, the employee has seen this facility as a threat for his/hers own job security. The most difficult task is to convince individuals that their contribution will give return to their organization as well as to themselves.

3. *The step evaluates* indicate that the organization should define its own necessary knowledge for its mission and classify its own currently intellectual capital. In other words, the knowledge manager does more than organize the content in system on-line; he/she should understand and foresee the community's needs.
4. *The step sustain or maintain* should assure that the future intellectual capital would maintain the organization viable and competitive. Organizations tend to build their own intellectual capital through their relationships with customers, employees, suppliers etc. The knowledge manager should also be responsible for the maintenance of the organizations knowledge base.

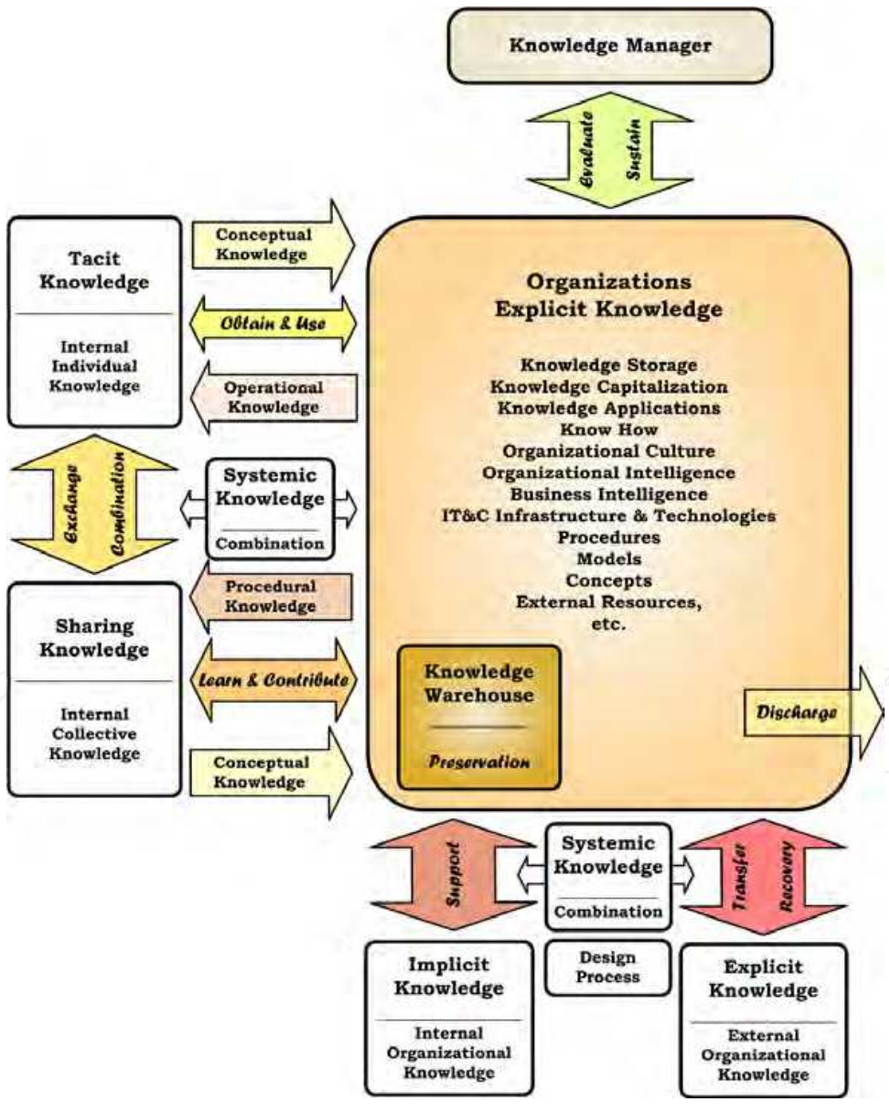

Fig. 9. A *knowledge management scenario* in SMEs as knowledge bases development support

5. *The step support* can be used for the continuous improvement of the product design process.
6. *The step exchange* represents an intelligence and creativity combination of organization employees to find better solutions to their problem. Knowledge exchange involves interaction between decision makers and researchers or project development teams and results in mutual learning through the process of planning, disseminating, and applying existing or new research in decision-making.
7. *The step combination* can be making by means of the Industrial Informatics Systems or Knowledge Work Systems.
8. *The step transfer* realized by teaching process, e-learning and simulations. At the organization level the knowledge could be found to individual or group (collective) resources.
9. *The step preservation* used for knowledge storing in a warehouse. In this repository, knowledge components, structured and classified, are deposited for further use.
10. *The step recovery* utilized when the organization must re-create knowledge that disappears because documentation isn't adequate or experts don't pass along knowledge before they leave.
11. *The step discharge* excludes any useless knowledge from the organizations knowledge base. However, some knowledge can be more valuable if transferred outside the organization.

4. Professional risk assessment as part of risk management process in SMEs

Risk management is the process (see figure 10) of identifying riskand its sources (Gavrilescu, 2009), assessing risk, and taking steps to reduce risk to an acceptable level (Rosu et al., 2010a). Commonly, the risk management process (RMP) includes three phases: *risk identification*, *risk analyses* & *risk feedback*. Risk management process is an important component of a successful project development process (see in figure 11 the project management process). Risk is associated with knowledge resources and infers that problems would be caused due to the loss or inadequacy of knowledge (McBriar et al., 2003).

In the enterprise, we can distinguish some basic project components (steps) in the development of a project: start of project study, start project planning, start project execution, basic project design ready, project introduction, project monitoring and controlling, release project product, project product acceptance, close project and retrospective investigation of project. The individual parties involved in a project adopt different terminology for describing risks, use different methods and tehniques for dealing with risk analysis and management, producing different and conflicting results (Tah and Carr, 2001). The complex relationship between an employee's knowledge, attitude, and behavior was not sufficiently explored (Khachkalyan et al., 2006). Enterprise project development presupposes knowledge and assumption of multiple risks. In a project, risks are those conditions or events whose occurrence is not certain, but whether they occur may adversely affect the project. The RMP should not be treated primarily as a technical function carried out by the IT experts who operate and manage the IT system, but as an essential management function of the organization.

In EU countries there is an experience and good practice both in classifying, identifying, and evaluating risks and in eliminating and reducing those (Botezatu et al., 2008). Among others we can mention that at SMEs level, a lot of attention is paid to: air quality (ventilation

systems), pressure equipments, elevators, lifting equipments and accessories, noise, construction sites, shipyards, illumination, electricity, individual protection equipments, explosives, extraction of fat using flammable substances, fires, fixed refrigeration systems, heat systems, machinery, flammable liquids or liquefied gases, chemical hazard, depots, air cooling towers, etc. (Yule et al., 2007).

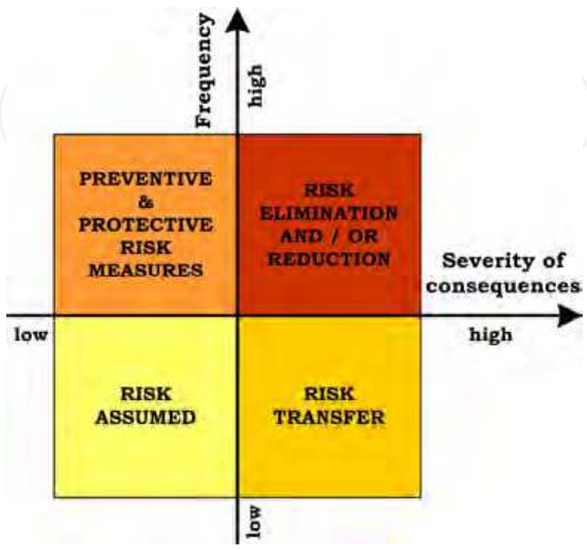

Fig. 10. The SMEs *risk matrix*

Risk identification consist of hazard identification. A hazard is anything that has the potential to cause harm. A hazard is identified as a situation with a potential for causing harm to human safety, the environment, property or business, regardless of how likely or unlikely such an occurence might be (Gasparotti, 2010). Hazards can affect people, property, processes; they can cause accidents and ill-heath, loss of output, damage to machinery, etc. workplace accidents and professional illnesses mustn't be perceived only as fatality, as it is more lucrative to consider them as a malfunction of the processes taking places in SMEs (Botezatu et al., 2008). Occupational risk refers to the likelihood and the severity of an injury or an illness occurring as a result of exposure to a hazard. The main aim of occupational risk assessment is to protect workers health and safety. Risk assessment helps to minimize the possibility of the workers or the environment being harmed due to work-related activities. It also helps to keep your business competitive and effective. Professional risk can be assessed in seven steps, as presented in figure 12 (Rosu et al., 2010a).

But, why is Professional safety and health an essential part of good SMEs business? Professional safety and health (EASHW, 2007b):

- Helps demonstrate that a business is socially responsible;
- Protects and enhances brand image and brand value;
- Helps maximize the productivity of workers;
- Enhances employees' commitment to the business;
- Builds a more competent, healthier workforce;
- Reduces business costs and disruption;
- Enables enterprises to meet customers' OSH expectations;
- Encourages the workforce to stay longer in active life.

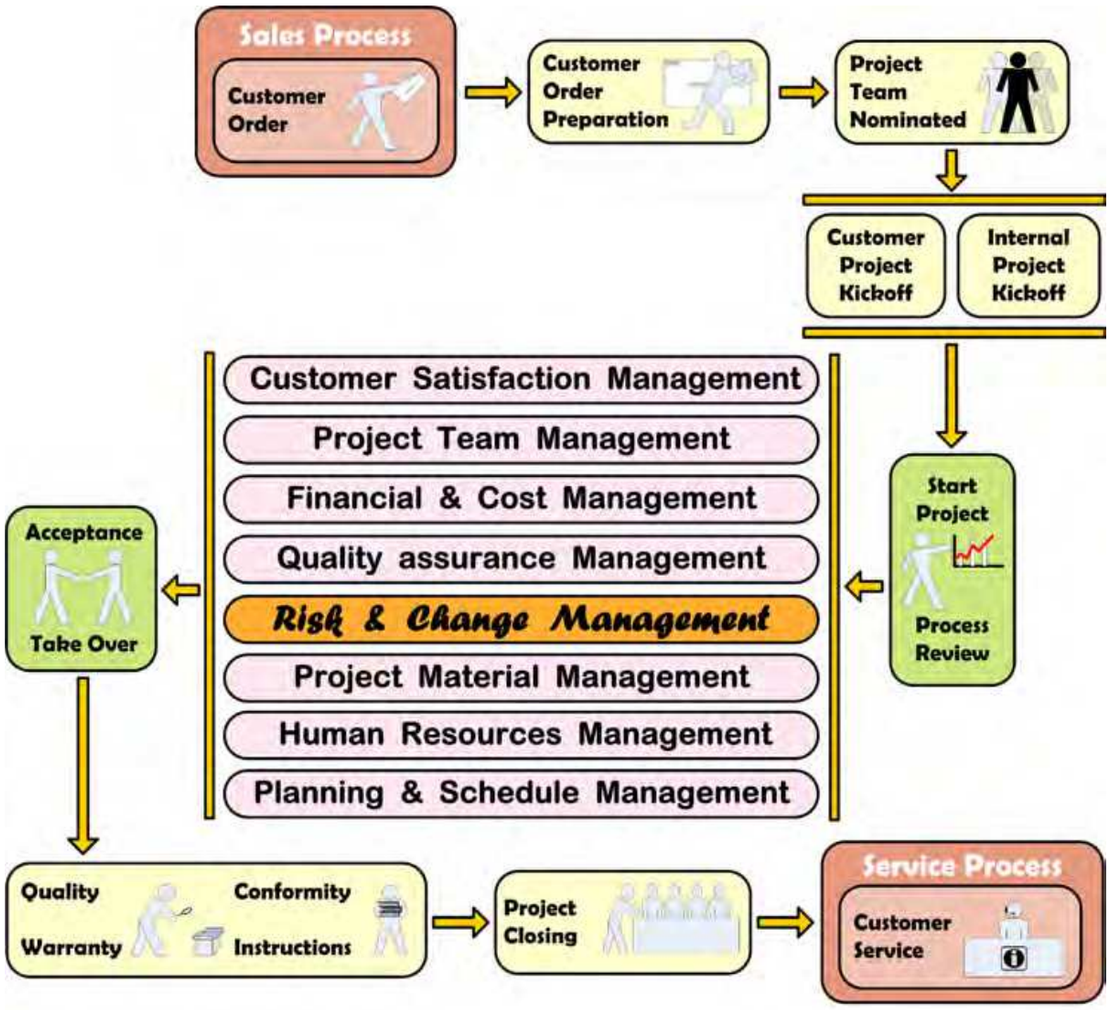

Fig. 11. The *risk management process* (RMP) as part of project management process (PMP)

Under health and safety laws, all employers must carry out regular risk assessment (EASHW, 2007a). To assess professional risk at the workplace we need to know:

- Where the workplace and/or the jobs performed are located and who works there: pay particular attention to those for whom occupational hazard may be more severe than usual, such as pregnant women, young workers or workers with disabilities; remember also about part-time workers, subcontractors and visitors, and employees who work off-site (including drivers, those visiting clients' or customers' homes, etc.);
- What work equipment, materials, and processes are used;
- What tasks are performed;
- What the potential consequences of existing hazards are;
- What protective measures are used;
- What accidents, occupational diseases and other occurrences of ill health have been reported;
- What legal and other requirements are related to the workplace, etc.

Fig. 12. The professional risk assessment (PRA) steps

5. A knowledge based system to professional risk assessment in SMEs

A knowledge-based system (KBS) is the one that captures the expertise of individuals within a particular field and incorporates it and makes it available within a computerized application (Lovett, 2000).

The KBSs help enterprise to diagnose processes in real time, schedule operation, troubleshoots equipment, maintain machinery and design service and production facilities. With the implementation of a KBS in the industrial environments, companies are finding that the real-world problems are best solved by an integrated strategy involving the management of personnel, software and hardware systems.

At PREMINV Research Center, University "POLITEHNICA" of Bucharest, have been implemented some of the KBS modules for risk assessment in various professional fields, system able to provide at the SMEs level the original KM framework (proposed in figure 9) implementation. A first KBS module is focused on professional risk assessment for an *Auto Service Company*.

To identify hazards at the workplace was prepared a General Hazard Checklist (see Table 1). This list can be extended according to specific facilities. Note that, correct identification of hazards involves active involvement of all employees in the process of gathering information.

For each YES answer in the general list is given 0 points and for each answer NO is given 1 point. Depending on the total score obtained and taking into account the probability and severity of consequences risk arising from hazards are evaluated – it may be small, medium or high.

Using expert systems generator VP-Expert (was used the expert system generator - VP-Expert version 2.1, by Brian Sawyer, Educational Version, distributed by Paperback Software International) and based on General Hazard Checklist was built the knowledge base *AUTOSER.KBS* (see figure 13).

The knowledge base rules are following: rules for awarding points variables, rules for calculation of the partial scores and total score and rules for assessment of probability and severity of consequences, and risk arising from hazards in accordance with the total score

obtained. To achieve the KBS professional assessment of risk was used the method of representation of knowledge production rules.

No.	Hazard	Yes	No
Does the hazard exist at the workplace?			
1	Do workers have suitable capabilities and skills to perform their work?		
2	Are flat surfaces (floor, inspection pit, etc.) regularly cleaned?		
3	Are flat surfaces (floor, inspection pit in service station, etc.) paint resistant from substances that are used (e. g., oil, diesel, petrol)?		
4	Is the inspection pit safely covered after work?		
5	Is the inspection pit suitably marked or surrounded with handrails to prevent people from falling down?		
6	Is the inspection pit suitably marked or surrounded with handrails to prevent people from falling down?		
7	Are there marked (e.g. on the floor) ways for cars to enter the service station?		
8	Are employees told not to step on brake tester cylinders?		
9	Are employees told not to step under raised vehicles?		
10	Is the temperature in the service station suitable for work in during both winter and summer?		
11	Are there defined safety rules for assembly work (e. g. bodywork, engine)?		
12	Are there defined safety rules for work with petrol tanks (e. g. repairing)?		
13	Are there instruction to avoid fire in the room in which batteries are stored?		
14	Are there measures implemented to avoid explosion when batteries are charged?		
15	Are there measures in place to protect electrical equipment from water?		
...	… … … … …		
Answer sum:			

Table 1. The Hazard Checklist

In the *AUTOSER.KBS* knowledge base (KB) there are *if-then* structure rules (excluding the rules for inference engine operations), such as:

```
RULE 0-0
IF      surfaces<>?     AND   clean<>?        AND   surfpaint<>?   AND
        oil<>?          AND   inspit<>?       AND   shoes<>?       AND
        lighting<>?     AND   ventilation<>?
THEN    FIND   rp1      FIND  rp2      FIND   rp3
        FIND   rp4      FIND  rp5      FIND   rp6
        FIND   rp7      FIND  rp8
        r1=(rp1+rp2+rp3+rp4+rp5+rp6+rp7+rp8);
... ... ... ... ...

RULE 6-1
IF      risk>18  AND
        risk<=20
THEN    prob=PROBABLE
        conseq=MODERATELY_HARMFUL
        riskprof=SMALL
CLS
DISPLAY"
EXPLANATIONS ++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Probable = may materialize only a few times during the occupational career of an employee.
Moderately harmful = accidents and illnesses not causing prolonged distress (such as small
nicks, eye irritations, headaches, etc.).
Small Risk = acceptable.
Conclusion = it is necessary to ensure that it will remain at the same level.
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++";
... ... ... ... ...
RULE 14-0
        IF      inspit=YES
        THEN    rp5=0;
RULE 14-1
        IF      inspit=NO
        THEN    rp5=1;
RULE 15-0
        IF      shoes=YES
        THEN    rp6=0;
RULE 15-1
        IF      shoes=NO
        THEN    rp6=1;
```

After querying the knowledge base will be displayed to evaluate the outcome of risk assessment conclusion and explanations on the likelihood and severity of injury in terms of consequences (see figure 13).

We considered the risk level depending on probability and severity of consequences as follows: *small risk*, *medium risk* and *high risk* and high risk are unacceptable and small and medium risks are acceptable (see figure 14).

In general, if the risk is assessed as unacceptable (height) reduction actions must be taken immediately. If risk is assessed as acceptable (average) is recommended plan of action

to reduce or necessary to ensure that it will remain at the same level (in case of risk assessed as small).

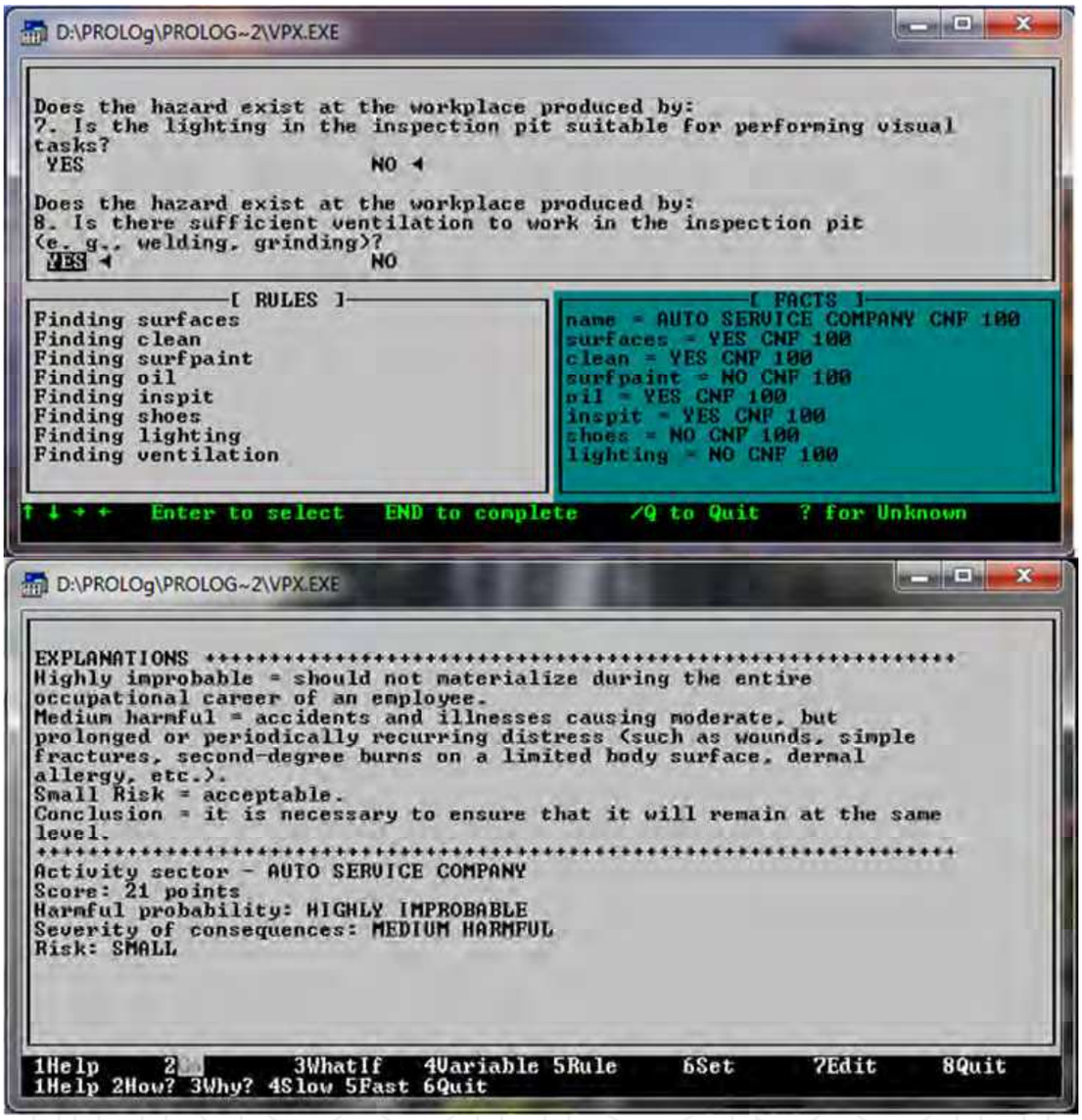

Fig. 13. The *AUTOSER.KBS* knowledge base interrogation and show results

Measures of prevention and protection to be implemented in the organization are to eliminate or reduce to a minimum the danger by organizational measures, or use of collective protection equipment suitable for individual protection. To reduce the risk it is necesary to take preventive measures (EASHW, 2007a), such as:

- Cleaning thoroughly after grinding, painting, etc.
- Wearing protective non-slipping shoes.
- Covering the steps into the inspection pit with non-slipping material.
- Never stepping under raised vehicles.
- Never stepping into a closed inspection pit in a service station.

- Never stepping on brake tester cylinders.
- Keeping inspection pits in service station covered after work.

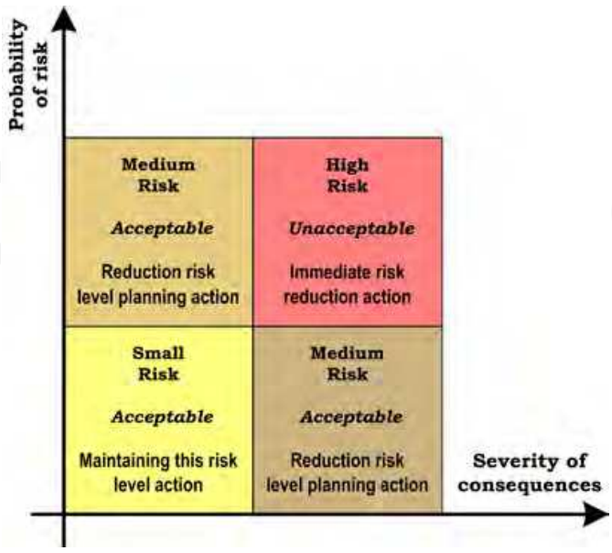

Fig. 14. The risk evaluation based on *probability* and *severity of consequence*

- Ensuring that all activities are performed by well-trained staff; respecting all required safety procedures.
- Using only recommended safe tools for work with batteries.
- Providing workers with necessary personal protective equipment (gloves, masks, safety shoes).
- Installing suitable lighting in the inspection pit.
- Performing regular medical examinations, etc.

It indicated a reassessment of activity sector after the implementation of these measures and to compare this result with that obtained at first evaluation in order to verify the effectiveness of measures for prevention and protection implemented.

6. Conclusion

This paper describes the SMEs knowledge and knowledge management key processes, the professional risk assessment as part of SMEs risk management process and presents a method to build knowledge based system to assess the profesional risks, starting from a SMEs knowledge management framework. Every business decision involves an element of risk (Lam, 2003). General idea that shows the importance of this system of occupational risks assessment consists in the fact that nothing can be achieved without a motivated/interested staff. The new methods, technologies, tools, techniques can be implemented only with the people and for people. It is particularly important that any technique or method to be presented by such a way as to appear in the eyes of the staff as a useful tool, and not as a tool for monitoring employee activity or suppressing it. In the European countries more then 95% of the companies are small and medium-sized enterprises (SMEs) and majority of the European Union employees work in these companies. In Romania just few SMEs develop proper risk measure and cover mechanisms. Regarding our companies the RMP in

the majority of annual report of Top 15 BSE (Bucharest Stock Exchange) Romanian listed companies 60 % are in an incipient stage of implementation, only 40 % of this Top 15 companies have already defined their objectives regarding risk management or already have an integrated system of risk management (Blidisel et al., 2008). According to legislation in safety and health, all employers should periodically assess the occupational risks. The main goal of the occupational risk assessment is to protect workers, helping to maintain competitiveness and enterprise productivity.

This work realized at the UPB - PREMINV Research Centre, in University "Politehnica" of Bucharest, is focusing on a university – small and medium-sized enterprise partnership. The validation of this methodology by a case study in the PROGPROC project (CNMP 11014/2007 – between 2007-2010) is to create a support system for resources planning and programming activities according to manufacturing processes management in virtual organizations. The future work in this area includes building other knowledge bases to evaluate eventually other SMEs activities who involve risks.

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