13th INTERNATIONAL CONFERENCE

MANAGEMENT AND SAFETY

M&S 2018

OHRID, MACEDONIA, June 15th and 16th, 2018

PROJECT MANAGEMENT AND SAFETY

PROCEEDINGS CD1

THE EUROPEAN SOCIETY
OF SAFETY ENGINEERS

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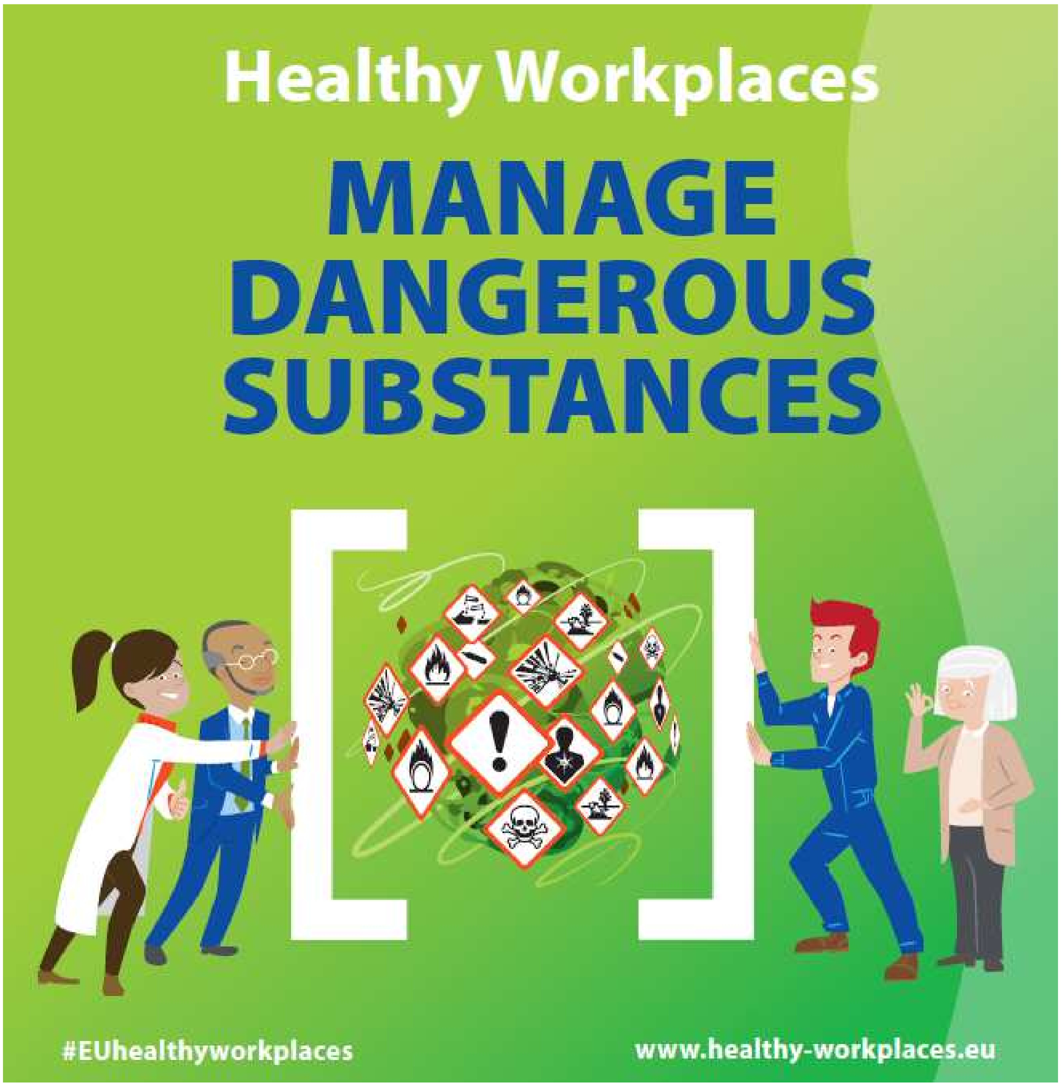

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Invited lecture

Srđan Glišović

ENVIRONMENTAL LIFE CYCLE MANAGEMENT AS A FRAMEWORK FOR SUCCESSFUL PROJECT DEVELOPMENT

Abstract

Environmental Life Cycle Management (LCM) addresses entire range of fields and activities, such as product design, material recovery, waste market exploration and waste exchange development. It explores possibilities to improve both the environmental performance and profitability of proactive companies. LCM based adaptation measures are most likely to be successful in dealing with issues of environmental protection, societal development and sustainability. LCM is a comprehensive approach that significantly contributes project management activities aimed to support an effective integration of sustainability aspects in regional business and economy. LCM is also found to be suitable to support strategic decisions of a company, and the use of LCM concept for strategy development is expected to increase significantly in the future. This paper describes LCM principles, advocates LCM approach among small and medium enterprises in the region of Western Balkans, and encourages project managers to recognize and improve environmental performances of their activities.

Key words: LCM, Environmental Project Management, Life Cycle Assessment.

INTRODUCTION

Project management is both an art and a science of planning activities and managing resources to lead a project toward its successful conclusion. The principal aim of any project management endeavor is to realize identified project objectives while constantly confronting with typical constraints: limited resources, required quality, and time available. Consequently, the purpose of project management is to plan, develop, control and complete projects within the scheduled time and estimated expenses.

Every project requires numerous human, financial and material resources to achieve desired outputs. Bucknall and colleagues [1] indicate that the term environment describes natural resource base that provides resources and accepts residuals, so a similar, broad definition of the environment is used in a World Bank's Environment Strategy background paper [2]. Therefore, the environmental aspects of project management (that comprise natural, anthropogenic, and social components) significantly influence outcome of any modern undertaking.

A common drawback in contemporary project planning is narrowing focus on economic analysis and negligence of environmental and social aspects of project development. The objectives for which a project was proposed might be jeopardized by one's inability to timely recognize and internalize adverse impacts of project activities on the environment. An environmental component of project management is of crucial importance for a successful project outcome. It is related to diverse issues such as safety, health, quality, risk mitigation, increased competitiveness, efficiency, liabilities, responsibility and sustainability. A reliable environment management reduces the unpredicted obstacles that may hinder the timely achievement of project goals, and help to mitigate the environmental consequences of project operations. The principal environmental issues resulting from manufacturing and urban operations comprise:

• degradation of air quality due to industrial activities and traffic increase
• contamination of land and water by pesticides, fertilizers, and hazardous wastes
• depletion of raw material deposits
• contamination of water bodies by discharge of industrial effluents
• irresponsible use of land resources

A well known tool for environmental management planning is environmental impact assessment (EIA). It is not just an instrument to facilitate regulatory compliance but also a tool for improving project management environmental performance. However, one more recent concept, named Life Cycle Management provides wider base for understanding overall impacts of entire range of project activities and resources used. Policies and plans only trace the route toward sustainable development, while the actions taken at a company or industry level matter the most in terms of environmental sustainability. Environmental project management, if carefully applied, could become an economic driver that would promote resource efficiency and thus minimize environmental damages.

The Project

There are numerous definitions of a project, which have been the subject of debate among project management professionals of all kinds. Some authors describe a project as a temporary, non-repetitive process, and as an effort that involves interrelated activities, which purpose is to achieve an objective [3] [4]. Turner define a project as an endeavor that produces a range of deliverables, applying material, financial, and human resources that are organized to carry out a unique work within predefined time, cost, and quality limitations [5]. According to the British Association for Project Management, a project is a set of interconnected tasks performed by an organization to meet defined objectives, which have defined start and finish time, is constrained by cost and resources, and have defined performance requirements and [6].

The International Project Management Association (IPMA) defines project as a temporary, time-limited endeavor with a defined start and finis, undertaken to meet unique goals, to provide beneficial change [7]. Possibly the most comprehensive project definition contents the 5th edition of Project Management Body of Knowledge (PMBoK) 2013, by the Project Management Institute (PMI). A project is defined there as “a temporary endeavor undertaken to create a unique product, service, or result. It implies that every project has a definite beginning and a definite end. It also means that the product, service, or result is different in some distinguishing way from all other products, services or results” [8]. According to the previous, a project might be development of any new system, structure, plant, or software, including the renewal or replacement of any of these.

The Project Management

On other hand, project management is a term that describes a planned, systematic approach to project realization. Project management applies skills, knowledge, methods, techniques and tools for the planning, leading, coordination, and reporting project activities, in order to meet project requirements. Project management is identified as the efficient way to manage changes that are expected as outcome of any project [6]. Badiru [9] portrays project management as the process of managing and allocating resources to timely achieve an objective. Project management institute (PMI) describes project management as the “application of knowledge, tools, techniques and skills to project activities to meet project requirements” [8].

Every large company should provide a reliable procedural framework and/or guidelines for managing projects, and thus enable leaders from various professional backgrounds to communicate mutually [10]. Managing projects has become an organizational skill that influence (and depend on) all company levels [11] [8]. However, the web of unprecedented environmental challenges [12] is generated by the great advancement in technology that causes depleting of environmental resources [13]. When it comes to the environment, a modern project management should discuss its protection, conservation and, if needed, remediation.

According to Project Management Institute, a project management is accomplished through application and integration of 47 logically grouped project management processes, 10 knowledge areas, technical and management skills, methods and techniques, which assist a successful and sustainable project result [8]. It was of utmost importance to identify the phases that follow the transformation of a concept into a product or a system. The sequence of these phases is defined as the project life cycle [14]. Various project management techniques and tools remain constant throughout the project life cycle which consists of planning, evaluation, controlling, and closing activities. However, the quality of risk-related information, including environmentally related ones, varies over the project life cycle, as well as the competences needed to process the information and to make decisions supported by the risk assessment [15] [16]. Organizational structure of progressive companies must be dynamic and transformable if environmental, social and economic circumstances require the change. Understanding of various sustainability aspects that evolve from changes in technology is needed for better control of resources [11].

Project Management Standards and Procedures

There are several standards for project management. While some of them deal with the processes of managing projects, the others are related to the competencies of the project manager, or to the organization that acquire a project. Most widely used PM standards include:

- ISO14001:2004 Environmental management system,
- NORSOK Risk and Emergency Preparedness Analysis Standards [17], developed by the Norwegian petroleum industry to ensure safety, environmental and financial effectiveness;
- ISO9001:2008 Quality management system, based on PDCA circle and Six Sigma methodology, a set of tools and techniques used for process improvement, and
- ISO21500:2012 Guidance on project management, that provides high-level description of concepts and processes that are considered to form good practice in project management.

Project management is based on well established processes. A process is defined as a “set of interrelated actions and activities that are performed to achieve a specified set of products, services or results, with defined inputs and outputs” [8] [18], while projects are “often utilized as a means of achieving an organization’s strategic plan” [8]. On the other hand, environmentalism was defined as “an advocacy or work toward protecting the natural environment from destruction or pollution” [19]. Hence, environmental management is closely connected with project management, since it should be an integral part of activities of every project manager at all phases of the project life cycle. However, certain components of environmental impact assessment (EIA) (e.g. monitoring and audit), also might be an integral part of the project initialization, production, and closing phases.

It is well known that sustainable development is an approach that strives to balance economic development with larger societal concerns, but environmental protection and fulfillment of societal needs are yet to become a standard practice in project management [20] [21]. Badiru describes project sustainability as “the ability to sustain and maintain a process or object at a desirable level of utility” [9], which might or might not comprise environmental sustainability.

Risk appraisal and risk management applied to environmental issues are rapidly growing fields [22]. Risk assessment is also used as a management tool for dealing with uncertainties, for improving workplace safety, and for recognizing priorities for the allocation of limited resources [22] [23].

It has been noticed that the implementation of an environmental management system (EMS) can provide several financial and non-financial benefits for an organization [24]. Companies implementing EMS frequently experience improvements of both environmental and business performance, such as better regulatory compliance, reduced waste and pollution, improved corporate image, advanced efficiency, increased customer trust, and increased revenues [25].

METHODOLOGY OF ENVIRONMENTAL PROJECT MANAGEMENT

A methodology is “a system of practices, procedures, and rules used by those who work in a discipline” [26]. Environmental project management methodology provides numerous benefits such as predictability of results, consistency, and improved treatment of the environment.

There are certain methodologies that provide a basis for a systematized approach to managing environmental projects, such as: the environmental management system (EMS), the PMBOK Guide, the PDCA circle and the DMAIC system. The processes and procedures can be applied to establish a framework for managing environmental projects in a consistent manner.

- ISO 14001 Environmental Management System (EMS) comprises the establishment of an environmental plan and the goals to reduce environmental impacts, the implementation of appropriate actions, and internal assessment or monitoring. The basis of an EMS is to record how a task related to an environmental impact is to be accomplished, to do the task, and periodically check to verify that the task is done as intended or to fix the problem. An EMS follows a Plan-Do-Check-Act (PDCA cycle). The model is continuous because an EMS is a process of continual improvement in which a company is constantly reviewing the system.
- The guide to the project management body of knowledge (PMBoK) is the accumulated knowledge in the sphere of professional project management. The PMBoK comprises

experiences and proven practices that were successfully applied, as well as some advanced techniques with limited use [27]. The PMBoK Guide is process-based and consensus-based standard that provides the fundamentals of project management, irrespective of the type of project [26]. The ten knowledge areas described in the PMBoK Guide are commonly accepted as best practices within the project management. The guide can be used as a tool for developing environmental project management procedures as well. The guide recognizes 47 processes divided into five basic process groups and ten knowledge areas that are typical of most projects. Each of the ten knowledge areas contains the processes that need to be accomplished while each of these processes falls into one of the five process groups, creating a matrix structure so every process can be related to one knowledge area and one process group.

- So called "Plan-Do-Check-Act" circle by Edwards Deming is a concept for the interaction among the project management processes. The result from one part of the cycle becomes the input to another. The circle works as a continuous improvement system, because the "Act" in "PDCA" means to reflect upon lessons learned and provide feedback for corrective actions for the next iteration. The four phases in the "Plan-Do-Check-Act" circle comprise the following activities:
    1. Plan: identifying and analyzing the problem.
    2. Do: developing, organizing, and testing a potential solution.
    3. Check: leading the project team, measuring the effectiveness of the test solution was; and analyzing whether it could be improved.
    4. Act: implementing the improved solution.

  PDCA circle illustrates the principles of project management, and supports the appropriate project management knowledge areas throughout the project life cycle.
- The Six Sigma System, so called DMAIC (define, measure, analyze, improve and control) is a problem solving methodology, used to approach an issue in a structured way and thus enable finding sustainable solutions. It is an integral part of a Six Sigma initiative, but can be implemented as a stand alone quality improvement procedure or as part of other process improvement initiatives such as environmental management systems. In contrast to the PDCA, the DMAIC approach offers an incremental performance improvement. The five steps of the DMAIC contain the following phases:
    1. Define the environmental problem: the project goals, and customer requirements.
    2. Measure process performance.
    3. Analyze the process to determine root causes of variation and poor performance.
    4. Improve process performance by addressing and eliminating the root causes.
    5. Control the improved process and future process performance.

Apart from above mentioned methodologies, the Life Cycle Assessment has proven to be a viable method for summing up entire environmental burden that inevitably follow every kind of project.

THE NEEDS AND CHALENGES FOR ENVIRONMENTAL PROJECT MANAGEMENT

Pollution often results in various chronic diseases, apart from affecting the quality of environmental compartments (i.e. water, air, and soil). The adverse effects on economic growth due to degradation of natural resources are often barely taken into account while planning and performing projects. It is often left out of perception that the most of economic activities and social well-being depend on the environment and that there is a proven correlation between these aspects. For instance, [28] claims that for the same period of time as gross domestic product (GDP) of India doubled due to increased industrialization in 1990s, the industrial pollution load increased fourfold.

The struggle for resources is becoming tougher as time goes by: there are land and water disputes, arguments and conflicts for rights over resources, and attempts by many to justify environmental degradation by increase of macroeconomic parameters. The awareness created by media is changing the way general population perceives and accepts project proposals and/or outcomes. Obviously, the environmental and social issues can no longer be treated as marginal problems. Projects where environmental and social considerations were omitted are often prone to substantial delays that as a rule rise expenses over prescribed budgetary limits. Some of such projects are being suspended or postponed for a long period of time.

For significant number of project managers, environmental management is all about getting an environment clearance for planned activities. From this narrow, regulatory perspective, environmental management activities are focused on avoiding the legal requirements, or at least finding the way to minimally comply with prescribed clearance conditions. Therefore, it is important to spread the understanding that environmental management is not about regulations, but rather about the essence of well being of contemporary societies - the very concept of sustainability brings together issues of environmental and human health, safety, and the resource efficiency. Hence, environmental protection and environmental management should be integrative component of all new undertakings.
It was proven many times that environmental incentives in project management can lead to viable economic benefits. According to [28] the construction industry is responsible for nearly 30% per cent of green house gas emissions, over 25% of energy consumption, 15% of water consumption and almost 40% of the waste generated worldwide. More than 20% of the wastes generated end-up in landfills while almost 15% of the acquired materials become waste, as a consequence of inadequate project management approaches. Hence, a proper environmental project management might reduce the cost of operation significantly and thus increase revenue. Environmental management activities (e.g. material handling and storage, reuse and recycling) provide effective utilization of resources in addition to reduction of project implementation expenses. Likewise, worksite safety, spill control, energy and water saving measures, as well as occupational safety measures also result in both financial and environmental benefits.

Construction of roads or other infrastructure also might result in devastating effects on the environment. Among other impacts, deforestation not only means a direct loss of wood resources, but also economic losses due to consequential erosion and landslides that might even cause sediment pollution of rivers and other surface water bodies. Appropriate planning and cautious project design of infrastructure projects can mitigate some of adverse environmental impacts of project actions. An environmentally responsible project management prevents the unforeseen obstacles that may impede the delivery of project results, and thus helps to improve overall environmental performance of project operations.

PRINCIPAL PROJECT-RELATED ENVIRONMENTAL ISSUES AND CHALLENGES

Industrial societies have created immense environmental burden in the name of development and growth, right in the middle of urban and industrial surroundings. It affects all environmental compartments and resources that mankind depend on for own subsistence. Certain damages of ecosystem are sometimes irreversible, or natural recovery may take a long time before remediation is complete.
Intensive industrial, agricultural and urban operations are responsible for the key environmental issues of contemporary civilization, such as degradation of air quality due to industrial and traffic pollution; contamination of land and water by fertilizers, pesticides and hazardous wastes; deforestation, raw materials depletion; contamination of surface waters due to discharge of sewage and industrial effluents. The aquatic systems and forests are even more sensitive to such detrimental changes. Intensive consumption of resources (e.g. minerals, water and forests) causes significant imbalances in the ecosystem services.
Global most ecologically productive and thus, most sensitive areas, often provide diverse and rich natural resource bases for industry and consumption. Societies worldwide exhibit high aspirations for economic development and in the beginning of 21st century a high growth in information technology, telecommunication, infrastructure, housing and industrial sectors has been obvious. This pace and of industrial and economic growth would certainly become unsustainable unless the issues of environmental safety are seriously taken into account. The nature of globally prevailing growth has contributed to the decline of environmental quality worldwide.

Besides the challenges that intensive industrial development brings about, climate changes and frequent disasters are a cause of concern as well. In given circumstances, developmental projects could require adaptation strategies and measures to mitigate the impacts of climate change alongside the traditional environmental issues. The nature and type of interventions vary in accordance with environmental conditions, geographical location, prevailing vulnerabilities, and risks caused by project activities.
Project managers should also consider possibility that a project can critically contribute toward cumulative impact of several ongoing activities in a particular area. In such circumstances, even

relatively small environmental load can overrun carrying capacity of a local ecosystem. Therefore, when it comes to large, infrastructure programs, project level environmental assessment studies should reflect conclusions from strategic documents such as regional development plans.
Addressing environmental issues in the framework of project management activities is always related to technological, financial, or time limitations. The developers often try to avoid their environmental liabilities encouraged by inefficient enforcement, weak monitoring, or by lack of coordination and communication across sectoral and regional boundaries.

ENVIRONMENTAL ASPECTS OF CONTEMPORARY PROJECT MANAGEMENT

Environmental management deals with diverse issues such as safety, health, quality, risk mitigation, increased competitiveness, efficiency, liabilities, responsibility and sustainability. In other words, improved resource extraction strategies, cleaner production approach, and good post-production practices will make a project or company performance environmentally friendly, and thus contribute towards increasing efficiency of a project operation by improving time and cost management. For instance, a road or highway construction project should integrate related environmental and social aspects from the project planning and design phase, through development and construction, and finally to post construction phase. During the planning and design phase, the focus should be on protection of community properties and resources (i.e. minimizing the land acquisition, forest cutting, water streams diverging, etc.).
During construction, emphasize should be on field activities, such as asphalt base technology and site management, restoration of temporary used areas, traffic management, and occupational safety. Relocation of community resources like cultural or religious properties etc should be carried out only after consultation with the concerned communities. Various design interventions can also help in reducing the undesirable impacts on environment. Where possible, a portion of the compensatory activities, such as re-forestation, should commence even before the construction is completed. Environmental and social considerations should be integrated into the planning procedures and statutory documents of every infrastructure project.
Every project organization should formulate comprehensive and clear environmental and social policies after widespread dialogues involving partners, NGOs, consultants and contractors. The documents and statements that follow the dialogues should be a tool for facilitating diverse environmental commitments.

LIFE CYCLE THINKING AND LIFE CYCLE MANAGEMENT (LCM)

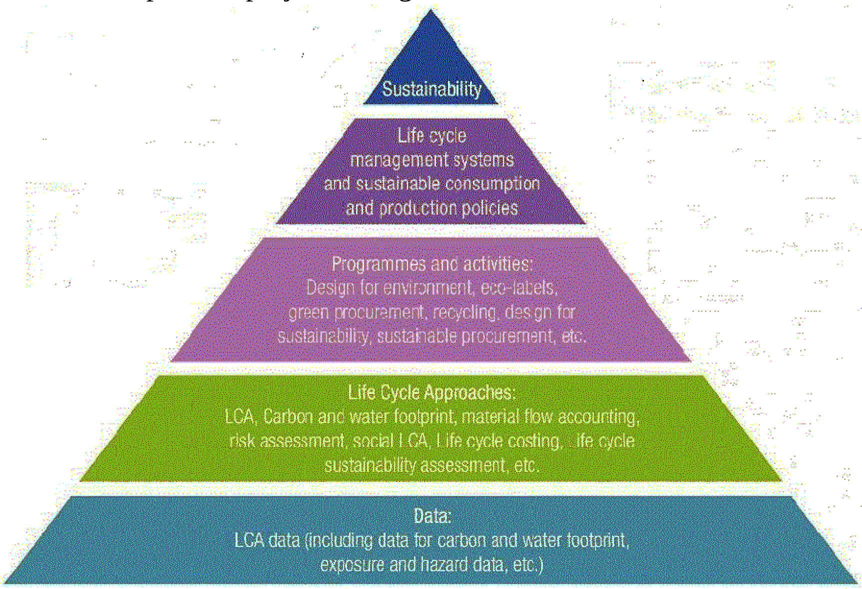
Sustainable development is supposed to improve societal quality of life without using up the planetary resources beyond the capacity of biosphere. However, the quest for sustainable development requires that businesses, governments and individuals take action, by changing consumption and production behaviors, and by setting policies or applying appropriate management approaches. Industries and businesses ought to find innovative means to improve the environmental and social performance of their products and processes in a profitable manner. Management of products' impacts on the environment along their life cycles helps to preserve ecosystems, and reduce the impact on humans [29]. A product's life cycle starts from raw material extraction, continues through different stages of manufacturing and than, through use, and finally ends with recycling, reusing or, when unavoidable, deposition. Taking into account the whole life cycle requires much more resources and aspects than traditional management. A life cycle approach requires significant amounts of data, viable methods, educated users and responsible management, in a structure described by Fava [30] (Figure 1).
To create a more sustainable business, industry has to expand the traditional economic aspects to include environmental and social dimensions [31]. Life cycle thinking expands the conventional focus on manufacturing and strives to incorporate various issues related to a product over its entire life cycle. The manufacturer becomes responsible for a product from "cradle to grave" and tries to develop products with improved performance in all phases of their life cycles.

Life cycle thinking is broader concept compared to pollution prevention, since it includes the entire product life cycle and considers overall sustainability. A product life cycle perspective adheres to eco-design principles and so called 6-RE approach to product design:

- Re-think the product and its functions. The product has to be used more efficiently, thus reducing energy consumption and other resources.
- Re-duce energy and material consumption (throughout life cycle of a product).
- Re-place hazardous substances with environmentally friendly alternatives.
- Re-cycle. Chose recyclable materials, and compose products in such a manner that they are easy to disassemble for recycling.
- Re-use. Design the product so that they could be reused as a whole by their components.
- Re-pair. Design the product so that they are easy to repair and long lasting.

The principal goal of life cycle thinking is to reduce resource overconsumption and decrease emissions to the environment in various phases of a product's life cycle, while taking into social performance of product system. Thus manufactures can provide cleaner products and processes, while getting competitive advantage over competition in the market.

Figure 1: Environmental aspects of project management



Source: Fava, J. (2011), Framework for Developing Greener Products in Iannuzzi, Al. Greener Products: The Making and Marketing of Sustainable Brands. CRC Press [30].

Life cycle thinking presupposes that a decision maker recognizes various impacts that occur along the life cycle of the product and understands how certain choices (regarding material, production process, source of energy, etc) influence those impacts. Therefore, the life cycle thinking denotes evaluating potential impacts under the decision making process.

The objective of life cycle thinking is to reduce resource use and emissions, as well as improve the socio-economic performance in different stages of a product's life cycle. It is an essential contribution to a concept of sustainability. It often requires that a company widen its views, as opposed to the traditional focus on the production site and manufacturing processes. Numerous environmental and social impacts, that regularly occur at each phase of the life cycle can be assessed qualitatively (life cycle thinking) or quantitatively (by a Life Cycle Assessment – LCA). The international standard (ISO 14040) prescribes how to conduct LCA that is now a widely accepted decision making tool for measuring environmental impacts and evaluation of related consequences.

Table 1: LCM Objectives, Strategies, Systems, and Tools.

Management Level	Social Aspect	Environmental Aspect	Economical Aspect
Objective	SUSTAINABILITY		
Concept	LIFE CYCLE THINKING		
Strategies	LIFE CYCLE MANAGEMENT		
	Corporate social responsibility	Pollution Prevention	Product and supply chain management
Systems	OHSAS 18001	ISO 14001& POEMS	ISO 9001 TQM, EFQM
Tools	Work place assessment	Cleaner Production LCA, EcoDesign	EMA & LCC

Source: Introduction to Sustainability and Life Cycle Thinking, UNEP Life Cycle Iniciative [32]

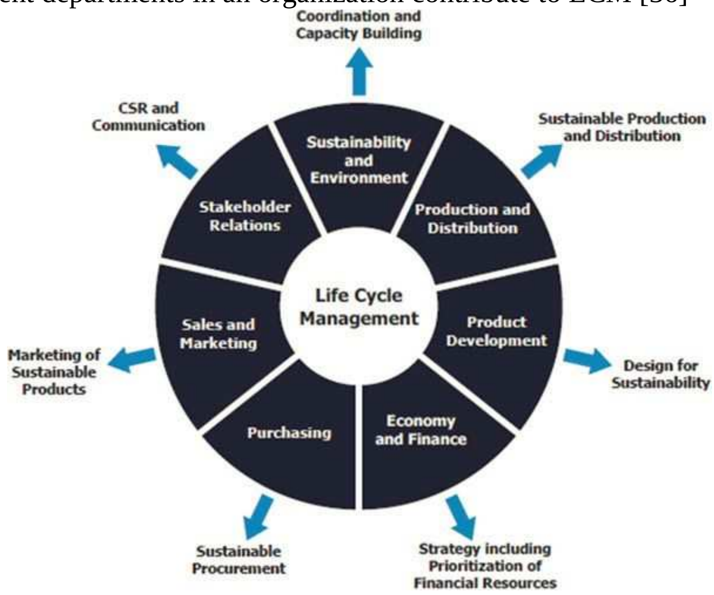
The Life Cycle Management LCM stands for application of life cycle thinking principles to contemporary business practice that aims to manage the entire life cycle of products and services of an organization, in order to achieve sustainable production and consumption. LCM is a system approach to sustainability, and it comprises product design and development, strategy and planning, supply chain management and communication among stakeholders [33]. However, LCM is not a methodology *per se*, or a single tool but a flexible framework of management concepts, procedures and techniques that comprise environmental, social, and economic aspects of products, services and processes.

Life Cycle Management requires synchronization of various existing tools and approaches, in order to advance the environmental, social and financial performance of a company. These tools and approaches can be grouped into 5 headings:

- Strategies and Concepts
- Systems and Processes
- Programs
- Tools and Techniques
- Data and Models

LCM can be adapted to the specific needs of an organization, as a voluntary and dynamic process. A company may begin with modest goals according to the resources available, and expand the scope over time [34]. Introduction of LCM concept is, as a rule, a decision made at top management level, in accordance with the organization’s policies and strategy. The concept is related to several departments of a company, such as research and development (R&D), supply, manufacturing, marketing, as well as environment, health, and safety (EHS) department (Figure 3). The department of environmental affairs usually coordinates initial implementation of an LCM system. However, small and medium-sized enterprises (SMEs) do not usually have such departments. Thus, LCM activities should be managed by a cross-organizational team consisting of representatives from each relevant functional unit [35].

Figure 3: How different departments in an organization contribute to LCM [36]



Source: Sonnemann et al. (2015), Life Cycle Management: Implementing Sustainability in Business Practice, in Life Cycle Management, LCA Compendium – The Complete World of LCA, Springer Verlag, pp. 7-21 [35]

Life Cycle Management (LCM) helps decision makers to create a foundation for viable and timely environmental management of a project. LCM is used to minimize adverse effects and enhance positive impacts on environment and society after a comprehensive analysis of the entire sequence of project operations. Therefore, LCM is much more than a tool for regulatory compliance. It is a powerful instrument for improving project management by adequate allocation of time, budget and, above all, appropriate expertise for the purpose.

DISCUSSION: LCM AS A TOOL FOR ENVIRONMENTAL MANAGEMENT

The main principles of environmental management should be applied through all the stages of a project's life cycle, beginning from project planning or design, and all the way to project execution and closure [37]. The best way to deal with environmental issues is to early recognize them and avoid them beforehand. It has been proven that the expenses, the time and effort dedicated to avoidance or minimization measures is usually significantly less than that spent on *post-festum* mitigation procedures. Thus, for instance, prevention of spillage of harmful materials is usually much simpler task compared to site remediation after the spill.
The LCM approach in project management facilitates formulation of an Environment Management Plan (EMP) that describes required environmental performance of a project in every phase of its development and throughout its field activities. The principal components of a typical environmental management plan comprise:

- an overview and a summary of the impacts of a project on the environment and immediate communities;
- the measures to mitigate, minimize and manage recognized adverse impacts
- monitoring and reporting requirements
- appointments and responsibilities;
- time plan for corrective actions
- expenses and budget for the purpose.

To justify its intended purpose, it is of utmost importance that the elements of environment management plan are integrated into the project design and, if applicable, in contract documents (which is usually the case with infrastructure projects). That is the point when the life cycle management of materials and processes could significantly facilitate rather comprehensive operative work, and enable defining the priorities or unavoidable trade-offs.

Project managers are often profit driven, and therefore mostly focused on quantitative and financial targets. However, the primary task of a good project manager has to be providing safe working conditions and protection against health and environmental risks to all employees and inhabitants that live in the immediate proximity of project operations. Aspects like pollution prevention and safety performance must not be neglected, throughout a project's life cycle. Therefore, environmental protection under a project should start with rather simple measures that are easy and inexpensive to implement. A project of any nature can be carried out in a cost-effective manner and simultaneously contribute towards environmental sustainability if certain, straightforward measures are taken on time. Such measures include, for instance, power and water saving practices, proper orientation of built environment and building smart houses, rainwater harvesting, green belts arrangements, use of secondary materials on site, regular maintenance of equipment, and alike. These practices can contribute towards improved environmental quality and are usually simple to adopt and carry out. Simple measures gradually become portions of action plans for worksites, and if proven effective, subsequently can be up-scaled for the company as a whole. Step by step, entire supply chain (upstream and downstream) can benefit from improved environmental performance.

Environmental management objectives are being accomplished through various interventions, such as product design, technology development, process improvement, packaging innovation, etc. Many of these activities require timely identification and budget allocation early-on in a project life cycle.
Successful environmental management also requires involvement of various stakeholders whether it is about planning of large industrial, energy or infrastructure project. Consultation and participation certainly help project management team to build confidence between stakeholders and thus increase transparency of decision-making. However, environmental sustainability can't be achieved only by formulating policies. It comes out of synergism between project management activities and individual actions of educated and well directed team members.

CONCLUSION

Wide spectrum of environmental pollution issues are well recognized by industry and general population, but the problem is that vast majority of decision makers fail to integrate and/or internalize environmental aspects with management requirements during project planning and development. Every project, in certain extent, contributes to some of principal environmental issues. However, correlation between environmental quality and human health is still rarely taken into consideration while planning and executing projects. Most decision makers, including project managers frequently neglect various adverse impacts that are bound to affect general population.

The projects are usually justified by desire to achieve economic growth and improve of quality of life. However, these general objectives of every project would be hardly reached if environmental pollution, industrial accidents or health risks result from project activities. LCM is a comprehensive approach that significantly contributes project management activities aimed to support an effective integration of sustainability aspects in regional business and economy. LCM is also found to be suitable to support strategic decisions of a company. Therefore the use of LCM concept for strategy development is expected to increase significantly in the future. Environmental project management should transform environmental expenditures into an economic driver for cost savings, while preventing environmental damages and promoting resource efficiency. Positioning sustainability in the focus of project management can bring significant benefits for environment, economy, and society as a whole.

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ANALYSES OF THE SPECIFICS OF EDUCATION FOR THE RESOURCES PROTECTION WITHIN THE CIVIL AND MILITARY EDUCATION SYSTEM

Abstract
Resource protection system represents an interdisciplinary subject which relies on novel scientific achievements, contemporary economic state and the existing practice of natural and artificial resource utilization. The possibility of sustainable resource utilization should be seen throughout process of responsible management and protection. In this sense, education for resources protection both within civil and military education system poses the similar aims, whereas the threats to it are observed from different standpoints. This paper elaborates the basic concepts of synergetic structure of resources protection, as well as specifics of education practice within civil and military educational system, both within formal and in-formal sense. The role of continual, life-long education practice is also analyzed.

Key words: resources protection, education, civil, military

INTRODUCTION

Contemporary working conditions and changing environments require a modern and dynamic organization that permanently changes, improves and adapts to the environment as a versatile system. Consequently, the need for changes in the organization is imposed, and the challenges posed by the transformation are forced to the management and governing bodies. Only managing and governing bodies that are ready for constant ongoing change and who possess the qualities of effective leadership, can make key changes in order to improve the performance of the organization through: restructuring, reengineering, quality-focused programs, integration, strategic reorientation, implementation of measures to protect resources and create safe working conditions [1].
In today's conditions, managing and administrative bodies must direct their knowledge effectively to knowing how best to apply the knowledge, bearing in mind that it is the main resource for the survival of organization are information processing and knowledge management. Prior to the management and administrative bodies of the organization, the key activities are directed towards efficient provision and allocation of human, natural and material resources in order to achieve the desired goal. This represents a set of specific knowledge management activities. The holders of these activities are specially trained for carrying out tasks related to the protection of resources. Resources protection means both the scientific and professional process of planning, organizing, deciding, managing and controlling human, natural and material resources in order to sustain and achieve the organization's success [2].

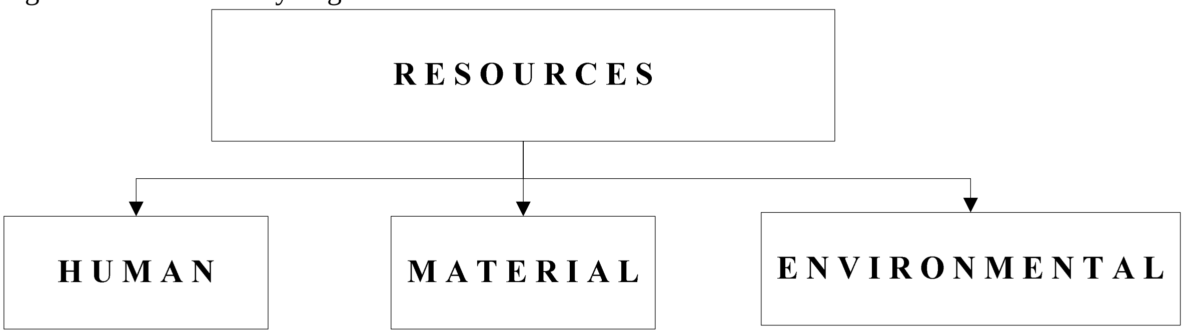
On the other hand, technological development significantly change the working conditions of almost every work place, and therefore the need for efficient resources protection is increasingly emphasized. In this sense, improving resource protection functions represents a system's sustainability function as it results in costs savings, but also enhances the reputation of the organization. Irresponsible resource management represents an enormous financial burden for the organization, and therefore requires an integrated, coordinated and strategic response, as well as cooperation between the main actors involved in the process of developing a policy to enhance resource protection. Ensuring the conditions for working in a healthy work and environmental protection in general means that the management of available resources should be based on responsible planning, sustainable use and preservation of the resources. Sustainable resource planning involves both creation of a basis for conducting plans and specific programs as well as basics of management and conservation of each individual resource, while reducing the negative impact of irresponsible resource use on an organization [3].

METHODS

The data used in this research were obtained partly straight from the source, partly indirectly, but the majority of the data were derived. The data collected using the examination method and content analysis were combined with the statistical method and special scientific methods, and they constituted the primary source of data in conclusion and verification procedures.

Operation of an organization in modern times requires a different understanding of the significance of resources for the organization. As the success of any organization depends on resources, there is the need for a new approach to organizing operations dealing with resource protection. Contemporary literature usually refers to resource protection as denoting natural resources and environmental protection, or human resources in the context of occupational safety and safety of human life and health. Material resources are mentioned only as raw materials required for work and manufacture of products. Modern conditions and needs of a modern organization necessitate that resources be viewed as being in a synergy and, as such, forming a structural whole (Figure 1).

Figure 1. Resources – synergetic structure



Source of figure [4]

The primary resources of any organization are the human resources, whose abilities contribute to the realization of organizational goals, which makes them the most important resources of every organization.

Decision making process as an essence of resource protection

Decision making is a cognitive process, whereby the decision maker is expected to:

- recognize the nature of the problem with which they, or the entity they manage, are faced in a given moment,
- define the desired, preferred, future state,
- evaluate the options (alternatives, solutions) that lead towards a desired state of the problem in relation to the decision maker or the entity they manage.

More specifically, the fundamental requirements for the decision-making process are the following:

- discrepancy between the current and the desired state,
- use of critical thinking on the part of the decision maker to identify the discrepancy between the current and the desired state,
- motivation (desire, readiness) of the decision maker to overcome the discrepancy between the current and the desired state,
- availability of resources that would help overcome the discrepancy between the current and the desired state.

Decision making is closely connected to management, since management comprises the following processes:

- planning,
- implementation,
- audit (control), and
- improvement based on audits,

while decision making comprises the following processes:

- initiative (problem recognition),
- decision preparation (analysis of the problem, desired state, and resources),

- decision making,
- decision implementation (by means of analysed resources), and
- control of implementation,

so decision making is a part of the management process in the narrowest sense.
In terms of probability (certainty), decision making can be classified as:

- decision making in a state of high certainty – usually pertains to the making of strategic decisions, when most determinants of the current problem, of the modes to overcome discrepancies, of the desired state, and of the resources are known (typical of adaptation processes),
- decision making in a state of low certainty – usually pertains to decision making when there is insufficient knowledge about all the aspects of the development of a desired future event scenario, about the modes to overcome discrepancies, and about the resources (typical of restructuring processes),
- decision making in a state of zero certainty, when most decision-making determinants are unknown, but there is still a need for decision making (typical of mitigation of negative effects).

At the other hand, reflective decision making involves objective multi-point pre-analysis as necessary step before final decision [5, 6].

RESULTS

Effective management of the organization's resources ensures their efficient utilization and organization at any given time that provides information on the available resources and, with no less importance, which areas are critical. The ability to accurately assess the capacity of an individual is the most effective way of allocating it. Adaptive measures in the event of a deterioration in the quality of resources are essential for the efficient management of the organization. Starting from the basic, abovementioned, division of resources to human, natural and material, in every organization, human resources are the most important one.
Using SWOT analysis there are listed strengths, weaknesses, opportunities, and threats to resources protection both within the Ministry of Defense, at the first place, which allows the identification of positive and negative factors that affect the choice and balance between internal capabilities and external possibilities, which is shown on Table 1.

Table 1. SWOT analysis of the resource protection system

Strengths clear vision, mission, and goals; operational efficiency; favorable educational structure of employees; existence of legal and normative acts for resource management; planning and organization of occupational safety and health; implementation of occupational safety and health; control of occupational safety and health;	**Weaknesses** insufficient number of professional personnel from the given field; insufficient number of suitable teaching personnel; inadequate training in the given field; insufficient knowledge and skills in the given field; insufficient employee interest;
Opportunities improvement of the current state of the given field in the EU accession process; promotion of the needs of protection implementation; employee motivation for implementing resource protection measures; control of training implementation and subsequent employee skills; introduction of mandatory classes at all education levels in the MoD; adequate training/education of current personnel; cooperation with university faculties from the same field;	**Threats** a drop in the economic standard; lack of adequate material capacities; resistance to changes; insufficiently developed culture concerning the given field; opposing views on the need for and scope of measures to be implemented; failure to understand the necessity of professional personnel at all levels; employee fluctuation;

Source of table [7]

In this sense, the content analysis method was used while gathered data on various characteristics related both to the implementation of measures and procedures of the resources protection and the implementation of security measures. The data that were analyzed were collected both from domestic and foreign literature, scientific books, brochures, expert papers, as well as from the reports on the implementation of measures of protection of resources. The collected data on the quality of the existing education program in the field of resource protection in higher education institutions were analyzed, based on the opinion of experts in this field. The selection of experts was based on their competence.

DISCUSSION

On the basis of the given analyzes and consultations with the experts in this field, the following conclusions were drawn. The degree of protection and organizational structure of resource protection depends on the following elements:

- continuity - priority of acquired resources need to be based on existing resources,
- substitutability - the possibility of access to appropriate resources of the same quality or similar,
- sustainability - the potential and utilization of resources must include the appropriate quality and
- exploitation of resources - maximum utilization of the resources of the organization, as follows:
    - concentration – focus resources on key goals of the organization,
    - conservation – use every part of the resources, where possible,
    - accumulation – to examine all spheres of functioning of the organization in order to determine where there is accumulation of knowledge and skills and how to combine them with the knowledge and skills of other organizations and other systems,
    - complementarity – combine all available resources in a way to complement each other and cover the disadvantages that they have and
    - recovery – getting results, but while taking care not to exhaust resources.

Success in implementing quality in resource protection implies an analysis of available resources, and above all:

- how to protect resources in the system,
- How to protect resources in the organization, respecting the rule that each organizational unit has certain specificities while implementing the protection of its resources.

Analysis of measures and procedures in protecting the available resources cannot be considered only at the level of system-organization, but must also be analyzed at the level of organizational sub-units. The functioning of the organization in modern conditions requires changes in the approach to understanding the importance of resources for the needs of the organization. As the success of each organization is conditioned by resources, it also poses the need for a new approach to the organization of jobs in the field of resource protection. Today, the most commonly used resources are environmental resources, while human resources are seen through occupational safety measures and protection of people's lives and health. Material resources are mentioned only as raw materials needed for work and product creation. Modern conditions and needs of a modern organization dictate the need for resources to be viewed through a synergetic link and as such constitute a structural entity.

Regardless of the type, structure and individual quantities, natural resources constitute the basis for the development of the country and each organization. A part of natural resources must remain outside the flows and needs of the organization and must be preserved for the future, and this applies in particular to resources that are non-renewable. The approach to the protection of natural resources must include defining the policy and strategy for their sustainable use, as well as defining the legislative and legal framework for their effective implementation.

CONCLUSION

Systems used in the process of resource protection, as well as the protection of the environment in general, the occupational safety and health of people and material goods, must be based on the requirements of the current legislation and international standards. Resource protection goals must be achieved through a range of activities defined by documented procedures, guidelines and applicable standards. In order to adequately protect and utilize resources, hazards and risks must be monitored regularly and minimized to least acceptable level. It is necessary to constantly invest in the education of

employees, which raises awareness of the need to implement measures and procedures in the resources protection area. It is necessary to continuously evaluate the general and specific goals related to the improvement of the resources protection impact and assessment in their implementation. Also, it is necessary to comply with legal and other regulations that need to be periodically reviewed.
The level of achieved knowledge in the field of resource protection indicates the need and, also, possibility of further research, while simultaneously reviewing the problem with the aim of improving the existing measures and procedures in the resources protection. In the presented research, the problem of research was assessed systematically, with consideration of objectively observed problems that have an impact on the implementation of proposed measures and procedures in the resources protection as well as the implementation of appropriate educational measures.

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- IEC 31010:2009, *Risk management - Risk assessment techniques*
- ISO 14001:2015, Environmental management systems - Requirements with guidance for use

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APPLYING PROJECT MANAGEMENT PRINCIPLES IN THE DESIGN OF THE TECHNOLOGICAL LINE OF THE FOOD INDUSTRY

Abstract

The project is a venture on a one-time basis, undertaken to create a unique product, service or other result. Starting from these facts, project management can be defined as the application of knowledge, skills, tools and techniques in project activities in order to meet the project requirements. Project management includes strictly defined requirements, clearly determined and achievable objectives, a balance between the conflicting demands for quality, time and cost, and compliance with specifications, plans and expectations of various stakeholders in the project. The paper presents an example of the design project for the technological line of the food industry - a plant for industrial production of bread and pastry. This project enables the placement of new products, contributes to the recruitment of new workforce and initiates the modernization of the new technological line by introducing innovative technological solutions in order to reduce potential threats and hazards to working and living environment.

Key words: project, project management, technological line of the food industry.

INTRODUCTION

The development of process industry enterprise is devised and implemented by project management. In terms of project management, the scope of development based on domestic knowledge and skills in the past was modest; therefore, technological development in the process industry was mainly realized by foreign sources of knowledge and equipment. Being familiarized with the principle of project management should be a consistent element of the general professional knowledge of every engineer. Expanding the engineering curriculum would not transform process engineers into project managers, but would enable them to handle and evaluate projects and use them for decision-making. Project management involves various specializations, while training in the field of project management should be performed thorough and performed in a step-by-step manner. The project manager gains expertise after diverse work experience, a great number of references and by fulfilling the legal requirements [1,2].

The terms project and design come from the Latin word *projicere*, which means to throw ahead, give something to someone, to conceive, to intent, or to make a plan. Anglo-Saxon literature uses the term *design*, which is in Serbian translated as a noun: design, drawing, sketch, concept, but also as a verb: to design, to draw and to make a plan.

Designing is a complex synthesis of many specialist activities that combine the teamwork of experts from various fields, such as: technology, mecahnical engineering, construction, architecture, electronics, economics, etc.

In the broader sense, design represents all the activities in the process industry starting from the primary and secondary research, through process-technical projects in general and the accompanying economic activities, to engineering-technical actions.

Engineering desing is a concept which is narrower than the concept of design in a wider sense. It does not contain primary nor secondary research, but only those tasks related to the realization of the process. When constructing objects, this narrow concept is often referred to as "*consulting*", which is wrong, since *consulting* in the first place means giving advice.

Designing in the narrow sense refers to the preparation and development of investment, technical and techno-economic documentation in the form of various studies, elaborates, design and implementation projects, and sometimes parts of investment projects [3,4].

Project management is the application of knowledge, skills, tools and techniques in order to fulfill the project's requirements.

PROJECT MANAGEMENT IN PROCESSING INDUSTRY

Project stages and characteristics

Basic characteristics of projects from the aspect of project management are as follow:

- **Temporary nature of project.** Temporarity means that each project has a certain start and the end.
- **Uniqueness of results**. Uniqueness is an important feature of project outputs.
- **Progressive elaboration.** It involves step-by-step project development.
- **Limited resources**. Resources can be provided from an existing organizational structure or from external sources, and can relate to people, equipment, material, or money.
- **Investors**. In most cases, the project has one main investor. Complex projects involve a large number of stakeholders.
- **Uncertainty**. It can be one of the main causes of failure to implement projects [5,6].

Project Management methodology

A set of processes, methods and tools for achieving a specific goal in project management is a project management methodology. All participants in the project must be familiar with the methodology used and the prescribed frameworks for its implementation. Project teams who use some of the developed project management methodologies are significantly more efficient and they implement all project activities with a higher level of consistency and a lower level of risk. In modern project management, two commonly accepted methodologies are identified: PMBoK (The Project Management Body of Knowledge) and PRINCE2 [7,8].

Classification of project management

In relation to project executives we distinguish matrix or joint projects, special projects, staff projects and individual projects. The classification of project management can also be carried out according to the following criteria: according to the risk (deterministic and stochastic), according to the purpose (scientific-research, development, military, investment, etc.), according to the environmental impact (with greater environmental impact and less environmental impact), towards the object of design (object oriented and process oriented), according to the degree of innovation (with a high degree of innovation and with a small degree of innovation). The classification of project management can be done according to other criteria [9,10].

Project stakeholders

Individuals and organizations that actively participate in the project, as well as the interested parties that might be affected by the outcome of a project, are known as project stakeholders. During the project preparation, the project manager and his associates should identify all the stakeholders, to formulate their specific requirements and expectations, as well as to define the range of their impact on project objectives and its successful implementation. In this regard, project stakeholders can be affected in two ways. Stakeholders could have a positive impact on the project, that is, they could benefit from successful project implementation, while on the other hand, there are stakeholders who think that the successful project outcome could have negative consequences.

Stakeholders most often involve the following: groups that directly influence the development of the project (project sponsor and project team members) and groups that have less impact on the project but have an interest in the project itself (project beneficiaries, business partners, managers, project management team, program manager, etc.). In addition to the above key stakeholders, there are several different categories of internal and external project stakeholders [11].

Project life cycle

All projects are divided into phases - beginning, middle (or several others) and the final - and they have a similar life-cycle structure. The number of phases in the project depends on the complexity of the project, as well as on the field of project implementation. All the stages of a particular project, if taken together, are generally referred to as the project life cycle. The life cycle of the project is a series of phases that represent the path a project takes from the beginning to its end. Depending on the manner the project is managed and implemented, the life cycle may have different forms [11]. The project life cycle is usually divided into phases according to the type of work performed over a period of time from its beginning to completion.

Project Management Triple Constraint

Each project implies that there are specific limitations in its implementation. Traditional project constraints are the basic constraints that must be met in order for the project to be successfully implemented and they involve time, costs and resources. These constraints are often presented in the form of a "project management triangle" that shows the interdependence between project constraints, primarily when changing one of the three main project constraints (Figure 1.). In practice, this means that if one of the restrictions is changed, other two constraints must be altered as well [10-12].

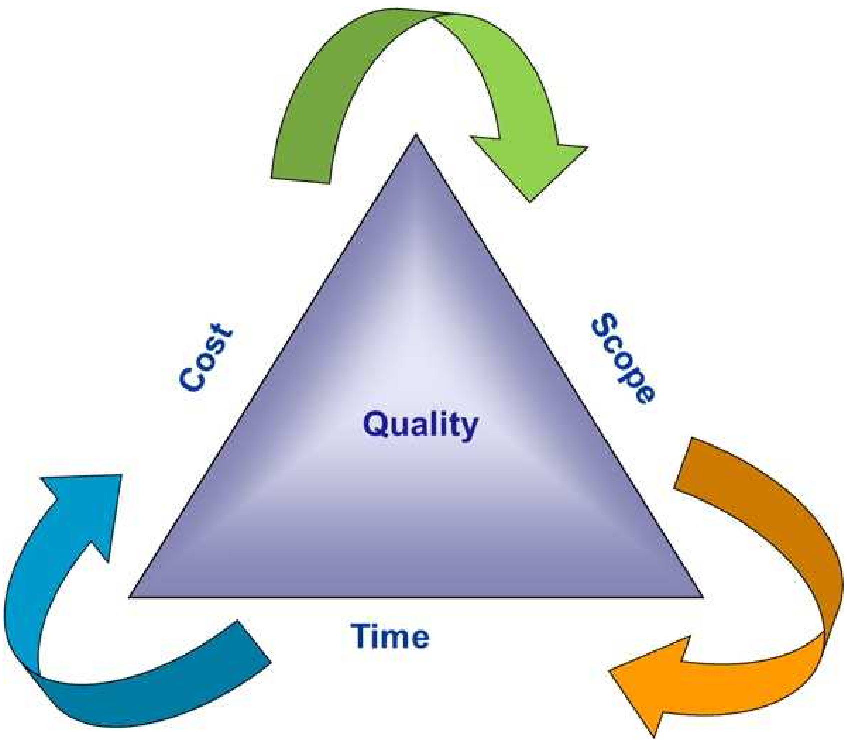

Figure 1. The Project Management Triangle [12]

CASE STUDY: APPLICATION OF THE PROJECT MANAGEMENT PRINCIPLE IN THE DESIGN OF THE PLANT FOR INDUSTRIAL PRODUCTION OF BREAD AND BAKERY

Project title

Designing a technological line of the food industry - a plant for industrial production of bread and pastry

Location

Niš, Serbia.

Project description

The project entitled "Designing a technological line of the food industry - a plant for industrial production of bread and pastry" is aimed at designing a technological line for industrial production of bread and pastry, with a capacity of 7900 kg per day. Overall daily capacities of bread making are 15,000 pieces in two shifts on one production line, while the capactities of bun-making are 8,000 pieces per day in one shift on one production line.
The main technological project needs to predict the storage for flour, the additives and yeast, the packaging warehouse, the production departments and the equipment departments. The accompanying departments are foreseen by the accompanying regulations.
Raw materials used for the production of bread and pastry must correspond to the quality and microbiological characteristics prescribed by the quality regulations. They must also meet the specific technological requirements for the production of bread and pastry.
The area used for storing flour should be clean for the operations of receiving and storing flour, and its minimum capacity necessary for seven-day production.
The storage space for other raw materials should allow for smooth storage activities in a period of seven days.
Yeast should be kept in a refrigerator with a minimum storage capacity for a seven-day production of finished products.
The bakery will be supplied with energy and energy fluids from the existing sources located at the site. Quality control of raw materials and finished products will be carried out in their own laboratory. Microbiological analyzes of raw materials and finished products will be entrusted to an accredited laboratory [3,4].
All waste materials generated in the production process must be removed from the plant according to their physical and chemical characteristics.
The bakery must not be a source of harm and danger to employees, nor the source of environmental pollution, and in this sense technological solutions in the project must be in accordance with the applicable legal regulations and quality standards [3,4].
The project will be carried out in four phases: preparation of documentation for designing the technological line and obtaining the necessary permits (technological procedure and production equipment, production capacity, raw material balance and energy balance), selection of contractors through tenders, training the employees and trial industrial production of bread and pastry [3,4].

Target group

Employees and consumers.

Desription of the problem

Problems that can arise when designing and using the production line of the food industry – a plant for the industrial production of bread and pastry - are multiple. The hazards that can arise when using the designed plant occur due to: improper selection of equipment and its poor functionality, disabled operation, uncontrolled repairs of devices and machines, incompetent and uncontrolled handling, fire and explosion, poor protection of moving and rotating machine parts, insufficient sealing of transport pipelines. Hazards that can arise when using the designed plant can arise due to: poor installation of driving devices and other equipment, bad climate conditions, poor quality assembling of transport pipelines, health risks in the dusty environment. Having in mind the above facts, it is necessary to take adequate protective measures. The foreseen safety precautions include the measures that are being implemented through: the production of technical documentation, the installation of equipment, general acts of the investor as well as during the course of work.

Overall aim

The overall project aim is defined on the basis of the requirements and needs on the market and it refers to the design of the technological line of the food industry, with the daily capacity of 15,000 pieces of bread in two shifts and the daily production of 8,000 pieces of buns in one shift.

Specific goals

Placement of new products, recruitment of new workforce, modernization of new technological line with innovative technological solutions in order to reduce potential harms and hazards in working and living environment.

Planned activities

Building a project team - The selection of the team that will guide the development and implementation of the project is crucial for success. The team should be composed of the experts with knowledge and experience. The very structure of the team will depend on the specific circumstances. Team members should comprise the designers in charge of designing a new line. In the later phases of the project development, a project committee should be established to perform technical control of the project. This body will be responsible for making important decisions that are not be within the scope of responsibility of the project management team. The project team is responsible for managing the project, or implementing the project. Members of this team should be those people who were members of the working team for the project preparation. In addition, it is necessary to involve experts and advisers in this field who will help in drafting contracts, developing payment mechanisms, identifying risks, assessing environmental impacts, etc. [4].

Preparing project documentation. In order to establish a technological line of the food process it is necessary to determine the location, i.e. to choose the site where the facilities and the accompanying infrastructure will be built. It is vital to solve property-legal issues pertaining to this site, to provide data on its area and other relevant characteristics, before the next steps that involve structural construction design and obtaining the necessary permits. Also, it is significant to examine the existing infrastructure (roads, communal infrastructure, telecommunications, etc.), and in case there isn't any, make plans for setting it up.

Procurement of necessary equipment. For the successful functioning of the technological line of the food process, it is necessary to build and procure adequate equipment.

Employee education. For the purpose of proper handling of technological equipment, the institutions will train a certain number of employees to properly handle technological equipment. Training of employees interested to work on the technology line will be organized with the help of the experts from the Faculty of Technology, while the experts from the Faculty of Occupational Safety and the Institute for the Quality of Working and Environment, “1st May“ will conduct a training for safe and healthy work with technological equipment of the technological line [4].

Informationand media campaign. A number of media presentations will be organized to inform general audience about new products for industrial production of bread and pastries.

Installation of technological equipment. After obtaining the consent on the Main project of the technological line for production of bread and pastry, a technological line will be installed. It is necessary to procure the equipment given by the specifications.

Selection of customers. Finished product will be offered to new buyers based on market research.

Project monitoring and evaluation. Project manager will permanently monitor the results and progress of project activities. The financial and time parameters should be monitored and compared with the planned ones.

Methodology

This project implied the principles that guarantee the successful implementation of the project. These are: 1) the involvement of different stakeholders; 2) distribution of information through the media; 3) experience of experts for implementation of activities and examples of good practice; 4) development of the capacities of the involved actors; 5) the sustainability of the project.
Therefore, the methods to be used during the project implementation are the following:

- Inclusion of different actors and the distribution of specific roles and obligations to each of them
- Using experience and best practices from other countries
- Information dissemination through the media and the website
- Promotion of project activities
- Education of employees
- Permanent monitoring of project activities

The methods for implementing the proposed project have been defined in accordance with the principles of active participation of the target group in the implementation of activities, so called "interactive" approach to optimizing project activities [4].

CONCLUSION

In order to fulfill project requirements and realize project activities, it is necessary to apply the necessary knowledge, skills, tools and techniques, i.e. it is significant to implement adequate project management. Project management includes strictly defined requirements, clearly set achievable goals, established balance between conflicting requirements of quality, time and cost, compliance specifications, plans and expectations of different stakeholders in the project. The basic principles of project management are applicable in different areas, but specific management activities need to be adapted to each individual project according to its specific characteristics.
In designing the technological line of the food industry, project management is rather specific, but like all other projects it implies managing and implementing the project in conditions of risk and uncertainty, with limited resources, within a defined time frame, with the defined cost and the demanded quality.
The basic objective of the project, that is to design a technological line for industrial production of bread and pastry with a daily capacity of 7,900 kg, was defined before the start of project activities and was defined in terms of measurable indicators of achievement. Production of bread with a daily capacity of 15,000 pieces will be performed in two shifts on one production line, whereas the production of bans with a daily capacity of 8,000 pieces will be done in one shift on one production line. This project will enable the placement of new products, contribute to the recruitment of new workforce, and modernize a new technological line with innovative technological solutions which are important in terms of improving the quality and quantity of finished products, as well as in terms of reducing potential hazards and threats in working and living environment.

The project will be carried out in four phases, starting from the preparation of documentation for the design of the technological line and obtaining the necessary permits, through the selection of contractors through tenders and training employees, to industrial production of bread and pastry.
There are diverse problems that may arise when designing and using the production line of the food industry, i.e. a plant for the industrial production of bread and pastry. Threats and dangers related to using a newly designed plant can occur due to: incorrect selection of equipment and its poor functionality, disabled movement while performing operations, uncontrolled repairs of devices and machines, incompetent and uncontrolled machine handling, fire and explosion, poor protection of moving and rotating machine parts and insufficient sealing of transport pipelines. Hazards that can arise are mainly due to: improperly mounted installation of drive devices and other equipment, bad climate conditions, poor quality of assembled transport pipelines, etc.

Having in mind the above facts, it is necessary to take adequate protection measures. The foreseen safety precautions include the measures that are being implemented by drafting technical documentation, installation of equipment and general acts by the investor.

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AUGMENTED REALITY IN SAFETY EDUCATION AND TRAINING

Abstract
Modern methods in education and training are applied in different dimensions. Particularly important is the application of augmented reality, which enables the situation from the real environment to be supplemented with additional information and explanations describing different work activities, necessary work procedures, as well as risks and hazards to which the employees are exposed. The working environment is “augmented” with digital information, based on the data collected from the work environment using various sensors. This paper describes basic concepts of augmented reality, as well as possibilities of application in occupational safety education and training. The advantages, disadvantages, opportunities, and dangers of applying augmented reality are also analyzed.

Key words: safety; education; training; augmented reality; performance indicators.

INTRODUCTION

Certain situations in which employees are exposed during work often require specific knowledge to provide an adequate response. The employees go through various trainings, and different forms of formal or informal education to be able to fully master the skills necessary for carrying out their working tasks, to be able to adequately respond to the occurrence of adverse or unforeseen events in the workplace and in the environment. The introduction of modern technology, in the early nineties, for various complex occupations introduced various forms of computer-assisted training, which put users into situations that could happen in a real environment. The virtual environment allowed the user to be exposed to the simulation of an actual and realistic scenario [19]. Such a computing environment puts user in a real situation, which requires certain response.

Limited capabilities in terms of hardware requirements affect the reality of created virtual environment. The lack of visual reality initiate bad reaction on users of such systems, which consider it as a kind of computer game, and not an educational application. Therefore, reactions of users are questionable, that is, it is not sure whether the same activities would be performed in a real environment, in which there are different visual attractions or markers. Hardware limitations have long been a major problem for creating realistic virtual environment. Complex simulators for pilot training and special-purpose drivers today have reached a level that bring a great deal of reality to the training. This also applies to training for machinery and devices, as well as in an environment that is static. In dynamic working environments, whose characteristics change over time, it is more difficult to create realistic scenarios in virtual reality. Solving the problem of the reality of the computer generated virtual environment is in combining the image of real environment and data necessary to understand the current situation. It is therefore a much better solution to combine a real image of the environment with information that helps users to fully understand the situation. This is called augmented reality. Such a combination allows the actual environment to be complemented by computer generated content.

Augmented reality

There is a difference between terms that describe computer-generated environments and combinations of computer-generated content with a real-world environment. That is why different concepts are introduced: virtual reality (or virtual environment), augmented virtuality, and augmented reality [17]. Users usually connect virtual reality with different third-person computer games, where user passes through a synthetic world in which he or she performs certain actions. Virtual reality defines all activities within a virtual world that is not connected with the real world in which users are located. Virtual

environments, like aircraft flight simulations, are some of the first serious applications of computer-generated environments in education and training.
Types of computer-generated environments and a brief description of their characteristics are shown in Table 1.

Table 1. Different types of computer-generated environments

Type	Description	Interaction
Virutal reality (VR), Virtual environment (VE)	Everything happens in a synthetic world, without insight into real-world activities.	Virtual world
Augmented virtuality (AV)	Combines virtual world and real world elements in a user interface, presenting the current state of the real-world environment.	Virtual environment
Augmented reality (AR)	Enhances the user's perception of the real world by presenting virtual objects and additional data upon the real world in real time.	Real world

Source: [3], [17]

Unlike virtual environments, augmented reality takes place in the real world. It extends the perception of users about the current state in the observed environment and possibilities of interacting with real objects by means of displaying additional information and virtual objects in the real picture and in real time. If interaction takes place in a virtual world or virtual environment, then such an environment is described by the term "augmented virtuality" [17].

Augmented reality application fields

Augmented reality combines physical world with computer generated data, animations or sounds and different effects. Some representative examples of augmented reality supplication fields are presented in table 2.

Table 2. Different applications of augmented reality

Application domain	Description
Architecture	Visualization of non-existing buildings on their previous or proposed locations
Army	Special training of troops, additional information about safe use of equipment, vehicles or weapons, and their important properties
Commerce	Visualization and presentation of objects in real environment
Design/development	Experiments with designed objects without creation of a model
Education	Advanced visualization for educational purposes, to show real situations in front of users
Entertainment	Interaction with virtual characters in real environment
Games	Presentation of virtual characters or objects with or over real-time objects
Maintenance	Detailed information about working activities and observed parts
Maps	Combining real-time view with maps and data about streets or objects
Medicine	Medical information about a patient or working activities
Television	Presenting additional graphical data for further explanations during live broadcastings
Tourism	Presenting information about important touristic places, capacities or events

Source: [2-4],[10],[12],[16],[18]

The most important challenges are security and protection, privacy and technological issues.

Technical issues

Technical aspects of using augmented reality are related to capabilities of technologies and the acceptance of the cost of their introduction. At the beginning, systems for augmented reality were large and non-transferable, which prevented their use in everyday work. However, with the development of technology, a miniaturization and technical capabilities of devices are achieved. Modern mobile phones and tablets, using network communication channels, allow some forms of augmented reality to be applied in practice and everyday work.

Privacy issues
A large amount of information is required to be available in the AR system. These are information about user locations, environmental characteristics, work activities and potential hazards. The problem of privacy and the misuse of data that can be confidential for an individual or organization is a major security threat. Monitoring individuals and recording their activities and habits can also be considered as a potential problem.

Safety and health issues
Studying security aspects of technology is a major problem in modern development, which means that generations of devices change over a period of 2 to 5 years. This is a short period to identify significant changes in safety, as well as the consequences for human health. Also, in many countries, human testing is forbidden, or strictly limited, which significantly complicates the study of health effects. Classical health problems and hazards due to the application of electromagnetic fields, as well as observation of objects at very small distances are known in other domains of application, and can be considered as very probable hazards, with additional psychological and psychosomatic analysis of users, with the possibility of potential addiction. Long-term effects of virtual reality on vision and neurological development have not been studied, but vertigo, head and eye pain, blurred vision, disorientation, balancing problems after longer use of the equipment have been reported.

METHOD

Factors and indicators of the efficiency of the application of the augmented reality
The notion of performance includes a set of indicators that quantitatively or qualitatively describe certain effects, contributions, and results achieved in the occupational safety and health system. Indicators are an important integral part of the management system, which includes the establishment, implementation and monitoring of corporate policies, the acceptance of criteria and objectives related to protection and training. Results from other activities represent information necessary for interpretation of indicators, and a set of indicators is a useful tool for defining management strategies.

The main factors that influence the application of augmented reality in safety and education are technical, human, organizational and environmental factors. Based on the research presented in [1-6], [10],[14],[16-19] and the authors' research [7-9], structure of factors and indicators of the efficiency of the application of augmented reality in safety and education (Table 3).

Table 3. Proposed set of factors and indicators

Factors	Indicators
Technical	Reliability; availability; mean time between failures; mean time between maintenance/repair; frequency of maintenance; infrastructure costs; maintenance costs; quality/reality of the display/presentation; proposed working conditions; usability
Human	Personal desire to use modern technologies; employee skills index; compliance with work procedures; degree of employee innovations; employee satisfaction index; number of errors and omissions; communication and reporting skills index; level of effectiveness of training programs; level of teamwork of employees; the percentage of employees with corresponding training
Organiza-tional	Percentage of employees trained for use of augmented reality equipment; resource and training management efficiency; share of working activities covered with adequate AR training and education; average value of years of employees' experience; percentage of jobs requiring special formal training; average number of hours of training of employees during the year; number of instructions for using equipment for employees; number of problems identified during the inspections and analysis of equipment or working conditions
External	Level of augmented reality technology; level of implemented legal procedures; competitiveness level; number of implemented voluntary standards; the degree of

	company networking; number of available instructional databases; number of available funds

Source: [1],[14],[16],[19]

The proposed structure contains 4 factors and 35 indicators. The structure can be further expanded by new indicators. Factors are connected to safety factors defined in [8], and indicators for each group of factors are selected according to specific circumstances based on augmented reality technologies and their practical applications in the domain of safety and safety education and training.

Group fuzzy AHP method

The fuzzy analytic hierarchy process is a flexible, relatively simple way to describe decision-making that include both objective and subjective factors in the evaluation process [8],[9],[15]. The process of applying the group fuzzy AHP method contains the following steps:

1. **Identifying and clearly defining the goal**. The goal is to rank key indicators describing the efficiency of application of AR systems in safety education and training.
2. **Identification of criteria and sub-criteria** t**hat contribute to the realization of the goal**. As criteria, aspects describing AR systems are identified (risk, costs and acceptability); as sub-criteria - factors that influence the quality of AR system (technical, human, organizational and external factors).
3. **Structuring the problem**. The problem is structured in the form of a hierarchy consisting of 3 levels.
4. **Comparison in pairs**. The pairs of problem elements at each level are compared on the basis of relative impact on the elements at the first higher hierarchical level. The decision maker or group of experts obtain relative impact of each pair on a goal, criterion, or sub-criterion using the Saaty's scale of comparisons (Table 4).

Table 4. Fuzzy numbers

Crips value	**Triangular fuzzy value**
Odd values	(1,1,3), (1,3,5), (3,5,7), (5,7,9), (7,9,9)
Even values	(1,2,3), (3,4,5), (5,6,7), (7,8,9)

Source: [15]

The result of the comparison is the square matrix A_{nxn}, where n is the number of elements to be compared. The elements of the matrix A, denoted by a_i, are estimates of the relative importance of criterion, factor or alternative i in relation to the criterion, factor or alternative j. These elements have the following characteristics: a_{ij}=1 for i=j, a_{ij}=1/a_{ij} for $i \neq j$.

5. **Aggregation of individual judgments**. The aggregated fuzzy matric consists of elements that are geometric mean value of all corresponding elements in matrices of individual experts.
6. **Determination of relative weights**. It implies the determination of eigenvalue vector, the elements of which indicate relative importance of elements being compared.
7. **Checking the consistency of estimates**. Consistency implies that coherent assessments are included in the decision-making process when comparing aspects, factors or indicators. The consistency determination process includes. Consistency checking of individual judgments is obtained by consistency index (CI) and consistency ratio (CR); if the consistency ratio is less than or equal to 0.10, the comparison can be accepted; otherwise, the evaluation must be repeated, or identified expert's judgment must be removed from further calculations.

7\. **Identify final priorities**. In this step, a final priority vector is defined (composite normalized vector or global priority vector), which describes the proportion of alternatives for achieving the goal. The final priority vector is determined by multiplying corresponding weights through the entire hierarchy, starting from the root to the leaves.

RESULTS

An explicit method of ranking and assessing the significance of AR indicators starts from the basic aspects of augmented reality equipment, describing risks (R), costs (C) and acceptability (A), factors that influence the quality of use (technical (T), human (H), organizational (O) and external factors (E) and broad list of indicators that are systematized according to key factors and indicators (Table 3). To determine key indicators important to safety education and training, this list is presented to assessors (experts). These experts took part in assessment. Of the 35 indicators from the list, the experts selected

16 key indicators (four within each group of factors), which best represent the state of application of AR systems in occupational safety and training. Key indicators are:

- Technical indicators (*Ti*): proposed working conditions (T1), quality/reality of display/presentation (T2), usability (T3), reliability (T4).
- Human indicators (*Hi*): personal desire to use modern technologies (H1), employee skills index (H2), degree of compliance with work procedures (H3), employee communication and reporting skills (H4).
- Organizational indicators (*Oi*): share of working activities covered with adequate AR training and education (O1), resource and training management efficiency (O2), percentage of employees trained for use of AR equipment (O3), number of AR equipment usage and safety measures guidelines (O4).
- Environmental indicators (*Ei*): number of available databases (E1), competitiveness level (E2), level of AR technology development (E3), number of available funds (E4).

The results of comparisons at different levels of the hierarchy are shown in Tables 5-9. Table 5 shows comparison of criteria. Tables 6-8 show comparison of factors in relation to criteria. Table 9 presents comparison The final weights of individual indicators describing the AR system are shown in Table 10.

Table 5. Pairwise fuzzy comparison of criteria (aggregated fuzzy matrix)

Goal	R	C	A
R	(1,1,1)	(0.73,1.2,1.8)	(0.87,1.4,2.2)
C	(0.56,0.83,1.36)	(1,1,1)	(0.73,1.4,2.2)
A	(0.45,0.71,1.15)	(0.45,0.71,1.36)	(1,1,1)

Table 6. Pairwise fuzzy comparison of subcriteria in relation to risk (R)

Risk	T	H	O	E
T	(1,1,1)	(1.4,2.6,3.8)	(0.86,1.1,2.6)	(1.03,2.38,3.78)
H	(0.26,0.38,0.71)	(1,1,1)	(0.47,0.82,1.4)	(0.86,0.9,2.6)
O	(0.38,0.91,1.16)	(0.71,1.25,2.14)	(1,1,1)	(1.05,2.18,3.39)
E	(0.26,0.42,0.98)	(0.38,1.11,1.15)	(0.29,0.45,1.02)	(1,1,1)

Table 7. Pairwise fuzzy comparison of subcriteria in relation to costs (C)

Costs	T	H	O	E
T	(1,1,1)	(1.41,2.4,3.4)	(0.85,1.47,2.62)	(1.01,2.18,3.38)
H	(0.29,0.42,0.7)	(1,1,1)	(0.6,0.91,1.8)	(0.87,1.18,2.62)
O	(0.39,0.68,1.19)	(0.56,1.11,1.67)	(1,1,1)	(0.88,1.62,3.02)
E	(0.29,0.46,0.99)	(0.37,0.82,1.14)	(0.33,0.63,1.15)	(1,1,1)

Table 8. Pairwise fuzzy comparison of subdriteria in relation to acceptability (A)

Acceptability	T	H	O	E
T	(1,1,1)	(1.27,2.2,3.01)	(0.83,1.27,2.58)	(0.87,1.8,2.6)
H	(0.33,0.45,0.79)	(1,1,1)	(0.57,1.05,1.67)	(0.71,0.87,2.2)
O	(0.38,0.79,1.18)	(0.59,0.95,1.74)	(1,1,1)	(0.86,1.5,2.6)
E	(0.37,0.56,1.15)	(0.45,1.15,1.42)	(0.38,0.67,1.14)	(1,1,1)

Table 9. Pairwise fuzzy comparison of indicators in relation to subcriteria

T	T1	T2	T3	T4
T1	(1,1,1)	(0.71,1.37,2.6)	(0.47,1.1,1.4)	(0.87,1.8,2.6)
T2	(0.38,0.73,1.42)	(1,1,1)	(0.55,1.43,2.6)	(0.73,1.6,2.61)
T3	(0.71,0.91,2.14)	(0.38,0.7,1.83)	(1,1,1)	(0.71,1.77,3)
T4	(0.38,0.75,1.47)	(0.39,0.63,1.36)	(0.33,0.57,1.42)	(1,1,1)
H	**H1**	**H2**	**H3**	**H4**
H1	(1,1,1)	(0.73,1.4,2.2)	(0.68,1.72,2.87)	(0.71,1.57,2.61)
H2	(0.45,0.71,1.36)	(1,1,1)	(0.58,0.87,1.8)	(0.68,1.73,3.02)
H3	(0.35,0.58,1.47)	(0.56,1.15,1.75)	(1,1,1)	(0.69,1.72,3.01)
H4	(0.38,0.64,1.42)	(0.33,0.58,1.47)	(0.33,0.58,1.47)	(1,1,1)
O	**O1**	**O2**	**O3**	**O4**
O1	(1,1,1)	(0.68,1.732.98)	(0.73,1.58,2.6)	(0.73,1.4,2.6)
O2	(0.32,0.58,1.47)	(1,1,1)	(0.52,1.4,2.6)	(0.7,1.27,2.18)
O3	(0.39,0.63,1.36)	(0.38,071,1.92)	(1,1,1)	(0.68,1.73,3.4)
O4	(0.38,0.71,1.35)	(0.44,0.79,1.4)	(0.29,0.58,1.47)	(1,1,1)

E	E1	E2	E3	E4
E1	(1,1,1)	(0.68,1.53,2.88)	(0.71,1.37,2.6)	(0.71,1.77,3)
E2	(0.32,0.65,1.47)	(1,1,1)	(0.6,1,1.8)	(0.7,1.27,2.1)
E3	(0.37,0.73,1.42)	(0.56,1,1.67)	(1,1,1)	(0.73,1.3,2.2)
E4	(0.33,0.57,1.41)	(0.42,0.79,1.4)	(0.45,0.77,1.36)	(1,1,1)

Table 10. Ranks of indicators

Indicator	Weight	Rank
T1 - proposed working conditions	0.0749	5
T2 - quality/reality of display/presentation	0.0750	4
T3 - usability	0.0777	2
T4 - reliability	0.0513	12
H1 - personal desire to use modern technologies	0.0734	7
H2 - employee skills index	0.0605	10
H3 - degree of compliance with work procedures	0.0610	9
H4 - employee communication and reporting skills	0.0450	13
O1 - share of AR training covered activities	0.0937	1
O2 - resource and training management efficiency	0.0739	6
O3 - % of employees trained for use of AR	0.0777	3
O4 - number of AR equipment guidelines	0.0534	11
E1 - number of available databases	0.0635	8
E2 - competitiveness level	0.0429	14
E3 - level of AR technology development	0.0418	15
E4 - number of available funds	0.0344	16

Source of Tables 6-10: Own source

DISCUSSION

The results show that, in order to use AR equipment, the most important thing is that technologies are at an adequate level and that users understand their importance in safety training and education. Costs are important both for equipment and for creating adequate program content. However, it is much more significant that these costs are cost-effective in terms of achieved results of their application in education and training. That is why technical and organizational factors are the most important, with less importance of human and external factor.

Comprehensive training is significant for application of AR systems. The technical characteristics of the equipment and usefulness, as well as the quality/reality of display/presentation are the basis for good results of training and education, as well as for acceptability by their users. Special working environment conditions may limit the use of a particular type of equipment. Efficient use of resources and training is important from the point of view of efficient safety system organization, and to organize realistic training, it is necessary to have a lot of data in different databases, both about potential adverse events, as well as about the ways in which they can be avoided or how they can reduce unwanted consequences for people or the environment.

CONCLUSION

Occupational injuries and occupational diseases, as well as adverse events in the work environment, are the causes of economic losses of every organization. In order to reduce the risks by means of effective management, it is essential that employees have adequate knowledge of potential problems. AR equipment can significantly improve the process of safety education and training, because the user analyses potential problems in real environment. Jobs that are done in a fixed environment (for example, using a particular machine or control desk) is much simpler for use of AR equipment in education and training, so training needs to be made for these workplaces first.

The paper describes the efficiency indicators of the AR system for application in safety education and training. The ranking of indicators is carried out using the group fuzzy AHP method. The results show the importance of good organization and level of technological development, and special attention should be paid to tailoring training to specific jobs, and levels of knowledge and skills of employees. The worst-ranked indicators are connected to external factor. Nevertheless, the level of competitiveness and technological development, as well as the available funds, can be a limiting factor for serious use of AR equipment in safety education and training. Periodical identification and ranking of key indicators can lead to better use of AR equipment in training and education.

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DESIGN OF THE MAIN FIRE PROTECTION PROJECT IN SERBIA

Abstract
The main fire protection project is one of the basic instruments of fire prevention and one of the integral parts of technical documentation. During building construction, the main project puts into practice all legal requirements related to fire protection and also provides control. The role of the project team or individual is to predict the preventive organisational and technical measures for the purpose of safeguarding the building and its users against potential fires and explosions.

Key words: fire protection project, prevention, technical documentation.

INTRODUCTION

According to Serbian law, the main fire protection project is designed for public buildings (cinemas, schools, hotels, etc.), as well as for residential and combined residential and commercial buildings whose height exceeds 22m, production and storage buildings, and electrical energy facilities with a nominal voltage of 110 kV and higher [3]. The main fire protection project is a distinct part of the overall project documentation required for building construction, which includes:

- The main architectural and civil engineering project;
- The main construction project;
- The main water and sanitation installation project;
- The main electrical installation project;
- Data on the technological processes in the building, provided by the investor.

FIRE PROTECTION PROJECT

The main fire protection project, as an integral part of the technical documentation required for building construction stipulated by the Law on Fire Protection, contains the following elements:

- textual documentation;
- budget calculation foundations;
- graphic documentation; and
- the priced bill of quantities for fire protection equipment and agents.

TEXTUAL PROJECT DOCUMENTATION

Textual documentation of the main fire protection project contains the technical report on the micro- and macro-location, technological process, installations, and fire prevention measures.
Specifically, the textual part contains the following:

- data on the building location, which are relevant for fire protection because they serve as evidence of implemented fire protection measures during the construction of buildings and facilities;
- criteria for the siting of residential, office, public, and production buildings, as well as special purpose buildings, in terms of protection against fire and explosions;
- building accessibility to firefighting vehicles and distances between buildings in the urban tissue and buildings of different purposes within the industrial zone, in terms of fire propagation and transfer;
- infrastructure data: description of buildings and installations for the transport of flammable liquids and gases, water supply buildings and installations, and other buildings and installation relevant for the layout of the location in terms of fires and explosions.

The portion pertaining to building description contains important elements for building protection against fires and explosions (building purpose, safe building placement, building construction, the amount of flammable and explosive materials stored in the building, construction elements of building protection against explosions, explosion relief vents, light construction, etc.). Fire hazard assessment involves fire risk assessment and classification of buildings in terms of vulnerability to fires, the purpose of which is to establish fire protection measures for the structure, materials, installations, and safety systems.
The project involves dividing buildings into fire sectors and describing construction elements in terms of their fire barrier function. Evacuation routes are determined through the review of basic characteristics of roads, evacuation directions, evacuation route geometry, materials built into evacuation routes, evacuation route obstacles – fire doors and the like, evacuation route installations, directional signs and notifications along the evacuation routes, etc.
The choice of fire-resistant construction materials involves the description of construction elements in buildings containing flammable gases, flammable and combustible liquids, and explosive materials, in warehouses, public buildings, and any other building where the structure has to be fire-resistant and the construction materials selected according to the building's purpose.

The choice of materials for the interior, for which specific fire-resistance requirements are in place, refers to the choice of materials for evacuation routes (in public buildings, high-rise buildings, residential buildings and buildings in which large numbers of people gather, buildings containing flammable and combustible liquids, flammable gases, or explosive materials).
Fire hazard assessment for fires originating from technological processes or from materials used or stored in them involves the definition of general terms regarding fire and explosion vulnerability zones (zone types and distribution), the amount of explosive materials, flammable and combustible liquids, and flammable gases stored in the building, as well as the description of building construction (construction type, material, explosion relief vent, etc.).
The description of installations, the basic functions, and integral parts of installations with technical characteristics that prove the installations are working properly constitute a separate part of the project pertaining to automatic fire detection and alarm installations. Description of installations for explosive and flammable gas detection includes the description of the installation with its primary functions and integral parts, including the technical characteristics that prove the installation is working properly[4].
The main project also includes the description of stationary and mobile fire extinguishing installations and devices (firefighting hydrant, stationary installation using CO_2, foam, dry powder, and the like) through a description of installation types, functional schematics, and integral parts of installations with technical characteristics that prove the installations are working properly. The choice of mobile fire suppression equipment involves choosing the type and amount of mobile suppression equipment and its layout and labelling.

Installations for flammable, combustible, and explosive fluids used in the building have to be provided through a description of installation type, installation requirements, and integral parts of installations with technical characteristics that prove the installations are working properly (fire safety valves; overcurrent valves; pressure relief valves; safety valves; relief valves; flame retainers; anti-explosion valves and other safety reinforcement of pipes, vessels, as well as tanks and facilities; piping, vessel, and tank materials; ducting and pipe connections; etc.).
The description of the smoke and heat exhaust ventilation system describes the installation type, installation requirements, and integral parts of installations with technical characteristics that prove the installations are working properly. The description of HVAC installations describes the installation type, requirements for and choice of materials, manner of installation and management, integral parts of installations with technical characteristics that prove the installations are working properly, passage through the boundaries of fire sectors, fire-resistant flaps, and particularities related to operation in an explosive atmosphere.
The description of the installation for building protection against atmospheric discharge contains a description of the installation type and integral parts of installations with technical characteristics that prove the installations are working properly, whereas the description of electrical installations contains a description of: requirements for the choice and placement of wiring and equipment; safety measures for electrical installations and equipment; integral parts of installations; classification of external influences; insulation materials; wiring systems and fire sector boundaries; electric shock safety; heat

safety; current overload safety; touch voltage and electromagnetic interference safety; safety systems in buildings; evacuation routing; backup power supply; functional connections with electrical elements of other installations; particularities of operation in an explosive atmosphere; grounding; safety conductors; and potential equalization conductors.

The project lists installations for draining static charge, through a description of the installation type and integral parts of installations with technical characteristics that prove the installations are working properly; it also describes other installations that affect the implementation of preventive measures during building construction[4].

THE BUDGET CALCULATION PORTION OF THE PROJECT

The priced bill of quantities for fire protection equipment and agents contains an overview of the technical characteristics of installations, devices, and equipment used to protect buildings against fires and explosions.

Budget calculation foundations are the basis for choosing the proper protection of buildings against fires and explosions. Numeric documentation of the main fire protection project contains

- pre-measurements of the fire load of fire sectors in the building; designation of zones of hazard from explosive gas mixtures; pre-measurements of installations for automatic fire detection and alarms; hydraulic and other pre-measurements of stationary fire extinguishing installations; estimates of the amounts fire extinguishing agents; estimates of evacuation route capacities, etc.
- the bill of quantities.

The pre-measurement of the building's and fire sectors' fire load is performed by first presenting the measurement methodology and technique, and then providing the evaluation of results.

The pre-measurement of evacuation routes involves the estimate of evacuation route capacity, determination of the passageway and exit widths, and so on [1]. The time required for the evacuation of people is estimated according to the evacuation time methodology.

The methodology for estimating structural stability of the building provides an estimate for construction elements and the overall structure.

GRAPHIC DOCUMENTATION

The graphic documentation of the main fire protection project contains fire protection measures that showcase the indispensable elements of protection in keeping with other main projects. The graphic prologue comprises

- a situational plan with drawn neighbouring buildings and roads;
- layouts of all levels and the roof with drawn fire sectors;
- characteristic longitudinal and cross sections with drawn fire sectors;
- layouts with schematic disposition of processing technological equipment and equipment belonging to fire extinguishing installations;
- layouts with schematic disposition of fire detection and alarm system elements;
- layouts with schematic disposition of gas detection;
- layouts with schematic disposition of directional signs;
- block diagram of the fire detection and alarm system;
- block diagram of gas detection;
- layouts with schematic disposition of locations of distribution cabinets and vertical risers;
- lightning rod installations;
- distributed machine fire extinguishing installations;
- smoke and heat exhaust system with a block diagram and disposition over the layout;
- HVAC systems with a block diagram and disposition over the layout;
- block diagram of electrical wiring distribution; and
- other built-in installations and systems according to technical requirements that ensure the safety of the building against fires and explosions.

DOCUMENTATION OF QUALITY AND TECHNICAL REQUIREMENTS

Documentation of the quality of built-in construction elements, equipment, devices, and installations of construction materials, which contains the issue of certificates of compliance, the testing procedure, as well as testing laboratories, is the integral part of the main fire protection project.

Technical requirements for products and compliance assessment include the following:

- definitions of the following terms: product; delivery; manufacturer; dealer; importer; distributor; deliverer; compliance assessment; compliance assessment authority; compliance certificate; appointment; authorization; technical assessment; technical specification;
- the manner of prescribing technical requirements for products;
- the definition of the term technical regulation, which is used to regulate product requirements;
- the manner of enacting a technical regulation;
- setting of technical requirements for products;
- requirement of compliance assessment;
- compliance assessment procedures;
- compliance assessment by the manufacturer;
- compliance assessment by the appointed compliance assessment authority;
- compliance assessment by the state administration body;
- the role of accreditation in compliance assessment;
- application procedure for bodies/authorities to perform compliance assessment;
- obligations of product manufacturers, importers, distributors, and end users;
- validity of foreign certificates and compliance labels;
- specific requirements regarding compliance certificates for materials, structures, installations, and equipment and devices used within the project.

APPROVAL AND REVIEW

The authorised government ministry has to approve project documentation, specifically, in the portion dedicated to fire protection, for the adaptation, reconstruction, and construction of buildings [2]. In Serbia, the main fire protection project is designed by a company or another legal entity that is officially registered to draw up technical documentation, authorised by the relevant ministry to design the main fire protection project, and that employs personnel who are licenced to design the main fire protection project.

The authorised government ministry approves project documentation, specifically, in the portion dedicated to fire protection, for the adaptation, reconstruction, and construction of:

- commercial buildings;
- public buildings;
- healthcare institutions, infirmaries, and institutions that house persons with special needs;
- block-type buildings, high-rise buildings, above ground and underground garages;
- buildings and spaces used for manufacturing, processing, and storing flammable liquids or gases, auto-combustible materials, toxic or corrosive materials, and oxidizers or other materials that can ignite or explode in the presence of water or oxygen;
- buildings used to manufacture and process flammable solids, resulting in explosive mixtures of gases, vapours, and dust;
- motor vehicle filling stations;
- industrial and storage buildings;
- electric energy facilities with a nominal voltage of 35 kV and over and substations with power exceeding 2,000 kVA;
- tunnels longer than 1,000 m;
- pipelines for oil, gas, and other products;
- buildings for manufacture and storage of explosives.

CONCLUSION

Fire is an unwanted combination of three necessary elements: flammable material, oxidizer, and the source of ignition, which are everywhere around people and are thus impossible to remove in order to reduce or completely eliminate fire risk. Therefore, it is necessary to control the risk. Probability of occurrence, frequency, and scope of the damage accompany each risk, so it is understandable that there are different levels of probability and scope of potential damage.

To control the risk, it is necessary to change the frequency and/or scope of the damage. Fire risk assessment, aimed at aiding risk control, needs to reflect the scope of the damage and represent it as unfavourably as possible. It needs to highlight the fact that a higher frequency rate is less acceptable and to show the effects of implemented preventive measures.

The aim of risk assessment for buildings and their content, users, and activities is to help the owner, employer, and/or appointed responsible person to identify potential fire hazards and devise optimal organisational and technical protective measures, which are compliant with legal requirements pertaining to fire protection. This constitutes the foundation for fire prevention and preservation of the structural integrity of buildings and physical integrity of their users.

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ENVIRONMENTAL PROTECTION PROJECT MANAGEMENT IN MINING AND ENERGY COMPLEXES

Abstract
Environmental protection project management in mining and energy complexes is a complex task. Use of network planning provides a basis for the design of a managing structure and the planning of environmental protection measures. In this paper, project management is based on the critical path method (CPM). The task completion time was defined, based on which the problems with the functioning of the environmental protection system were analyzed.
Hiring employees of different professions is one of the fundamental prerequisites for the creation of a team well-suited to manage projects regarding the conservation of air, water, and soil quality. Use of corrective protection measures is an important condition for harmonizing the operations of mining and energy complexes with EU regulations and ISO 14000. Therefore, the paper considers the hiring of personnel for the reclamation and remediation of areas degraded through coal mining.

Key words: environmental protection, mining and energy processes, project management

INTRODUCTION

Adequate decision-making of the management of mining and energy complexes, based on the management of the environmental protection project, implies harmonization of economic and ecological principles with the energy needs of the state. Planning of work activities should be carried out thoroughly in order to solve potential problems, before emergencies occur and before the occurrence of unwanted consequences. The world's energy situation is a global problem that must be tackled at the local level.

Research subject

In this paper, the subject of the research is the management of the environmental protection project, which can play an important role in mitigating the consequences of the operation of mining and energy complex. Management which is based on environmental protection principles and an adequate environmental protection policy allows for the reduction of causes and levels of environmental problems.

Current research

The management of the environmental protection project based on current research leads to mitigation of the consequences of coal exploitation and combustion. Modern research methods, such as Balanced Scorecard, Analytical Hierarchical Process (AHP), and Critical Path Method (CPM), enable the identification of criteria, defining of management goals and the development of a management project based on the application of Deming Circle and planning, implementation, control and operation processes (PDCA: P-Plan, D-Do, C-Check and A-Act).
The application of current research allows for the rational planning and realization of preventive and corrective measures for environmental protection. Management procedures can be planned using network planning and they are questioned by analyzing the critical path.

The aim of the research, the hypotheses and the tasks

Efficient organization of the environmental protection management system, in the mining and energy complex, research, while as alternative targets there are plans for continual improvement of the management of protection of working and living environment. The hypothesis of this paper is that the responsible behavior of the management of the mining and energy complex in the process of

implementation of the environmental protection project management creates a real basis for doing business in accordance with the prescribed laws and standards.
The management tasks of this project are modeling of the environmental protection management system, in order to allow for the detection of negative consequences for the quality of air, water or soil.

METHODS

Modeling the interdependent relationships between environmental, energy and economic problems is the basis for overcoming the problems encountered by representatives of the energy sector leadership. Workers who carry out work on the protection of the living and working environment in the mining and energy complexes have a great responsibility and are aware that they cannot fully comply with the environmental protection policy and all legal norms.
Current issues require an urgent solution to the accumulated problems and support in making good decisions. The methodological framework for the modeling of the environmental protection management system of the mining and energy complex comprises of the implementation of the ISO1400 (EMS) series of standards, the ranking of environmental aspects (AHP), management strategy choices (BSC) and the network planning method for managing the project for improving the management system (CPM) [1].

Deming Circle and PDCA

The environmental protection management system in the mining and energy complex implies reliability and safety, as well as productivity and economy. ISO 14000 and Deming's management circle present the possibility to identify existing problems in the planning, implementation, control, and operation procedures.
The operation of the environmental protection service of the mining and energy complex and the work of the management representatives in charge of the environmental protection depends on the available technical possibilities and the work of obsolete equipment. Identification of problems in the application of legal norms in the areas of environmental protection and mining and energy indicates the failures of the management representatives of the mining and energy complex in charge of environmental protection in the execution of their accepted work obligations.
The proposed management project, using modern management methods or conventional management procedures, reduces the need for making subjective decisions. Activities related to the acquisition of experience, engagement of experts and realization of financial and technical conditions are envisaged.
The modeling of the environmental protection system in the mining and energy complexes will be done on the basis of recommendations of the ISO 14001 standard prepared by the Technical Committee ISO / TC 207 Environmental Management, Subcommittee SC 1, Environmental Management Systems [2]. The Environmental Management System model is based on the guidelines of the International Standards Institute for Project Management ANSI / PMI 99-001-2004 (American National Standards Institute/Project Management Institute) [3] and BS 6079, 1-3 2002 (British Standards Institution) [4], which imply the establishment of the project management framework, the life cycle analysis and the organizational structure of the project.

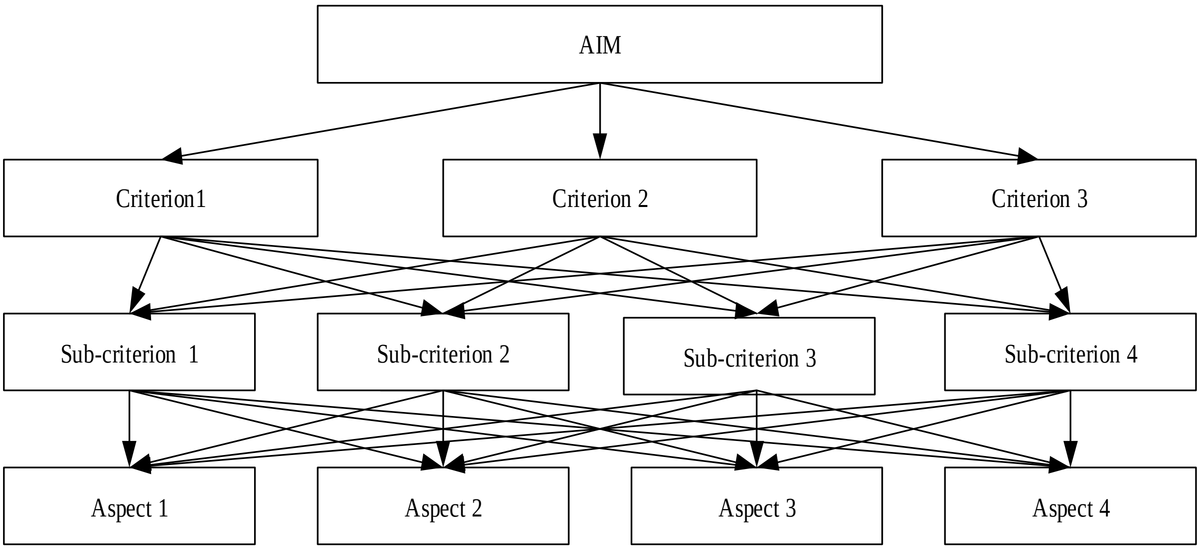
Analytical hierarchical process

An analytical hierarchical process based on multi-criteria assessment and the selection of work activities that are most endangering the environment can be positively applied, but only if the criteria and sub-criteria are adequately defined. Assessments of environmental impacts should be based on relevant statistics and measurements of official institutions. It implies an assessment of the consequences for the quality of the environment, based on the likelihood of occurrence and the degree of impact. Comparison of the harmfulness of one effect with respect to others should be done, as well as in relation to the criteria and sub-criteria laid down, as given in the graphic representation (Figure 1).

Balanced Scorecard

The selection of the management strategy using the Balanced Scorecard, based on the list of the most significant consequences of the mining and energy complex operation is the basis for decision-making without any subjective impact. Defining the environmental protection management system, with the analysis of environmental and social aspects, is the basis for the implementation of the adopted general and specific objectives.

Figure 1. Scheme of the hierarchical structure of the problem in the AHP method [7]



Source: Own source [7]

Decision-making based on AHP and BSC methods

Deciding on the basis of a number of different treatment options [5, 6] implies choosing realistic solutions to the problem and deciding in the conditions of certainty, risk or uncertainty [7, 8].The model of the system based on defined tasks [9, 10, 11] should include the influence of the mining and energy system on the health of the employees and the population of the surrounding settlements. The consideration of stakeholders' views reduces disagreements [12].

One person can take part in the decision-making process, which initiates or favors a particular action or event [13], but decision-making is most often based on the analysis of real problems. The basis of the AHP method for displaying dependencies on different hierarchical levels [14, 15] was set by Thomas Saaty in 1980. Each alternative choice is characterized by a number of alternatives [16]; in this case also the environmental indicators.

The operation of the Balanced Scorecard method was defined by Kaplan and Norton in 1992 [17], with the possibility of continuously correcting the offered solution. An analysis of the objectives of financial management, internal processes, education of workers and stakeholders [18] is carried out in order to fulfil an acceptable definition of objectives [19].

Sustainability Balanced Scorecard (SBSC) [20] aims to enable the definition of important strategic environmental and social objectives of the organization in order to formulate environmental management strategies [21, 22].

RESULTS

The model of improvement of the environmental protection management system of the mining and energy complex, based on the implementation of the ISO 14000 standard, is the basis for determining the risky activities in the process of exploitation and combustion of coal which results in the deterioration of the quality of air, water and soil.

CPM in managing the environmental protection project

The environmental protection management project in the mining and energy complex based on the CPM method aims to establish critical work activities through the network planning technique. The goal is to define corrective protection measures and to align the execution time with complex tasks. Managing projects using MS Project (MS Office) as a support tool allows visualization of management models and facilitates the management process.

The planned activities and precisely defined duration of activity are presented in Table 1.

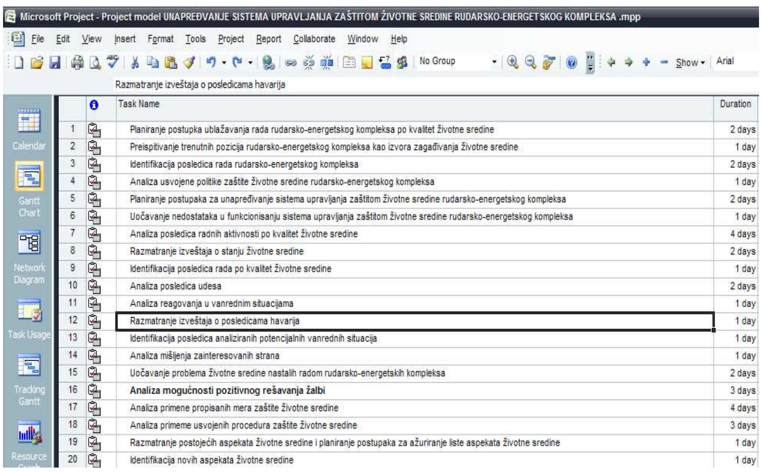
Table 1. List of initial activities of the project for improvement of the environmental protection management system of the mining and energy complex

	Work activity	t (dan)
1	Review of procedures and failures in the organization of protection activities	2
2	Reviewing the position of the mining and energy complex as a source of pollution	1
3	Identification of risky work activities	2
4	Analysis of omissions in the implementation of environmental protection policy	1
5	Planning the procedure of management process correction	2
6	Identifying shortcomings in the functioning of protection management tasks	1
7	Analysis of consequences of coal exploitation and combustion	4
8	Consideration of environmental quality indicators	2
9	Identification of consequences for the quality of air, water and soil	1
10	Analysis of the consequences of emergency situations	2
11	Analysis of the response in case of exceeding the limit values	1
12	Consideration of report on the consequences of accidents	1
13	Identification of consequences of failures and accidents	1
14	Analysis of opinions and complaints of the public	1
15	Realizing the real problems	2
16	Analysis of solving the observed problems	3
17	Analysis of the need for corrective measures	4
18	Analysis of the implementation of the adopted environmental policy	3
19	Consideration of the environmental aspects	1
20	Identification of new environmental aspects	1

Source: Own source

Project management with the application of the MS project tool and network planning techniques starts with defining the activity and duration (Figure 2).

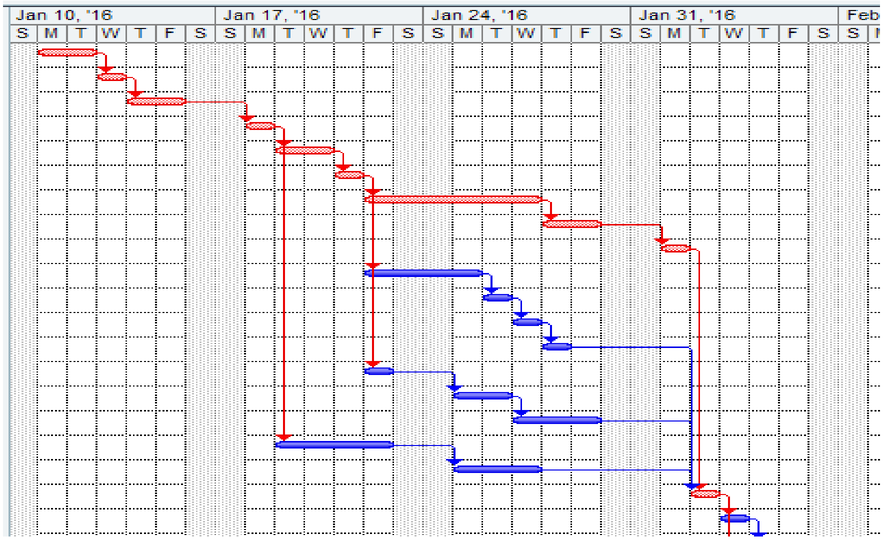
Figure 2. Activities of the project for improvement of the environmental management system



Source: Own source [7]

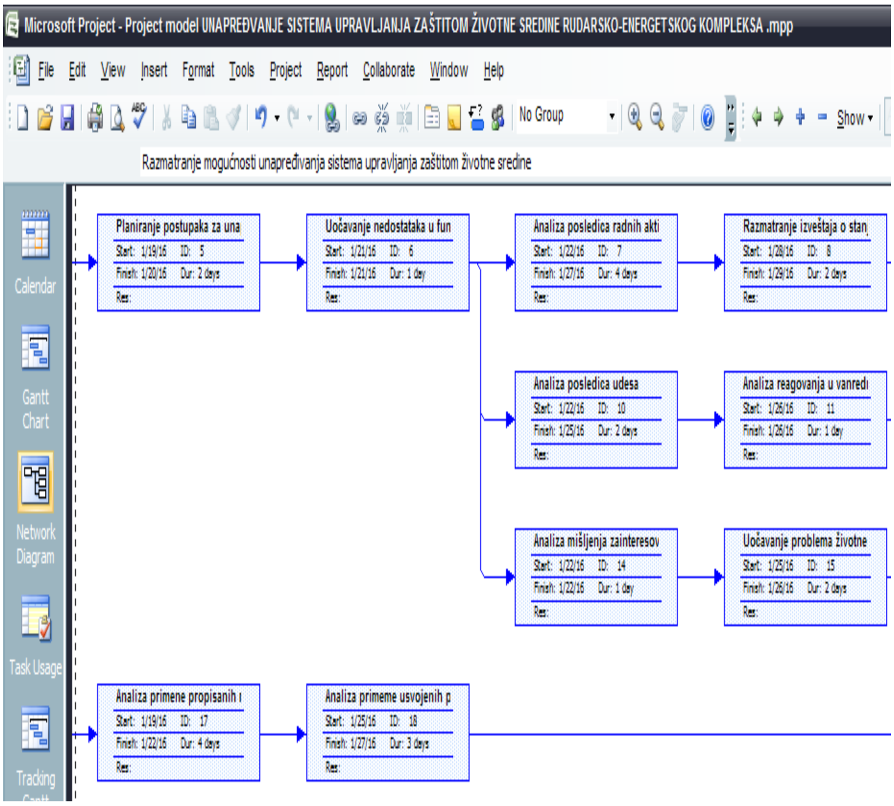
The order of performing the activity of the model for improvement of the environmental protection management system is represented by the Gantt chart (Figure 3) and the network diagram (Figure 4).

Figure 3. Gantt chart of the activity of the analysis of the application of the adopted environmental protection measures and the consequences of emergency situations



Source: Own source [7]

Figure 4. Graphic representation of the activity of the analysis of the negative consequences of the mining and energy complex



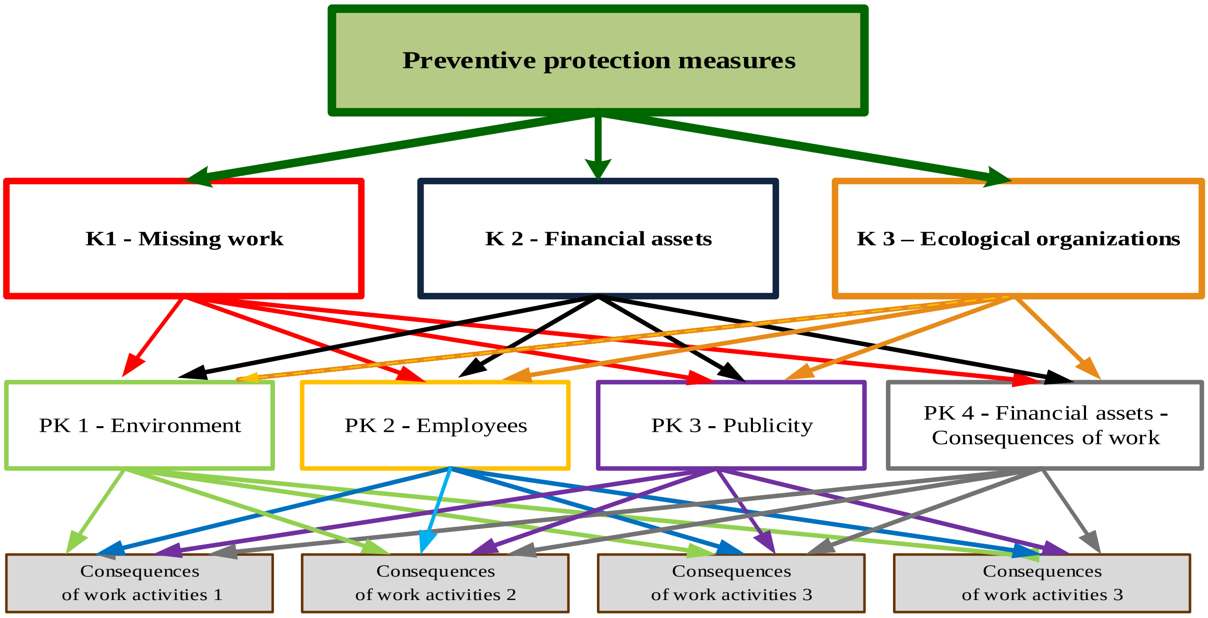
Source: Own source [7]

Based on graphic representations (Figure 3 and Figure 4), the branched structure and the need for parallel execution of several operations are noticed, which points to the complexity of the environmental protection management project.

AHP in managing the environmental protection project

The method of assessing the significance of aspects (AHP) is based on the analysis of risky work activities and the ranking of consequences of coal exploitation and combustion. The estimates obtained are classified into nine categories, on the basis of which the environmental aspects are ranked. The hierarchical structure formed from 3 criteria, 4 sub-criterion and 4 aspects is shown in Figure 3, in order to present the complexity of the project for the management of environmental protection.

Figure 5. Hierarchical decision-making scheme using the AHP method



Source: Own source

Elements of one level affect the elements of the first next higher level in the hierarchical decision tree [216], and the weight distribution is done on the scale of "nine points" [225], with the value 9 representing the most significant negative impact [226] on the environment. The results of the comparison of key work activities are the essential elements of the calculation.

DISCUSSION

The model for improvement of the environmental protection management system of the mining and energy complex, based on the analysis of project management, as a tool in determining how to overcome the problems, is a complex task for the team of experts. The implementation of the guidelines of the ISO 14000 series of standards, requirements of the Constitution of the Republic of Serbia and the Law on Environmental Protection, is a complex task, the completion of which is uncertain. The model was designed to enable easier detection of problems and avoiding subjective decisions in defining objectives, resources, tasks, responsibilities and powers. The consequences of the operation of the mining and energy complexes should be a clear signal to the management to modernize the environmental management programs. Functioning of the environmental protection management system indicates additional engagement and the need to comply with legal provisions.

CONCLUSION

The management of the environmental protection project in the mining and energy complexes, based on the use of modern management methods, is the basis for mitigating the consequences of the operation of surface mines and thermal power plants. Modern management methods, based on probability theory, multi-criteria decision-making and analytical hierarchical process, are not the basis of management in the field of mining and energy. The application proposal is defined with the aim of reducing the responsibility for making subjective decisions and facilitating the functioning of the environmental protection service of the mining and energy complex.

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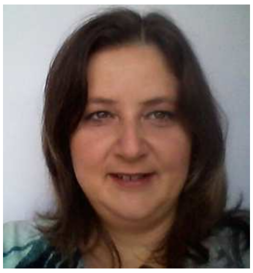

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HEALTH AND SAFETY RISKS IN MINING INDUSTRY – CAN POSITIVE EXAMPLES MAKED DIFFERENCE

Abstract
Mining industry has a reputation for being a risky business, with health and safety risks that are varied and often quite serious, so it is important for miners to protect accordingly. Nevertheless, mining doesn't have to be unsafe. Introduction of strict safety rules and procedures, as well as advanced safety equipment, the mining industry has seen its fatality rate drop over time. To be successful, best practices in any organization must be deeply ingrained into the corporate culture and supported from top management on down through the ranks. This is especially important in mining and other high-risk industries where safety awareness and consistency are essential in helping to prevent accidents, injuries and fatalities. The paper describe the Sasa Mine example, where successful implementation of tailor made safety improvements led to 483 days without LT injuries during the last two years. Sasa mine works on continuous improvement of H&S conditions by introducing a variety control and improvement tools, through an open process that never ends, using "we can always do better" approach.

Key words: health and safety, risk management, good practice, mining.

INTRODUCTION

The issue of health, safety and environment (HSE) remains one of the top priorities in the local, regional and global mining industry. Efficient health and safety at workplace not only ensures that employees are happy and productive, but can also help to reduce both the human and business costs of injuries and unnecessary lawsuits. By making health and safety the priority, mining companies are effectively communicating that competent employees are a valuable resource in the industry. Additionally, improved health and safety standards help companies become more effective to finish projects on time and improve their business profile with customers and clients. By introducing basic health and safety standards, mining companies can understand the human capital benefits this has across the company [1].

Mine managers and individual miners need to adhere strictly to operational safety procedures. Employers need to provide the right tools and training to every employee to protect the life, health and safety, as well as to protect valuable worksites and assets. As leading mining organizations already know, creating a safe working environment means a more productive and profitable mining operation. It also leads to higher levels of worker morale and job satisfaction, which in turn improves employee retention. Taking a holistic view toward improving worker safety education and safe work practices is a sound business investment that pays dividends for long-term success.

HSE standards and technical specifications must first be discussed and implemented before any person steps onto any mining site, whether in an established facility or a new site. Also, gaps between local and international HSE standards can be bridged through an approach that involves a method statement, risk assessment and job safety analysis.

Understanding and being aware of your environment is the first step to preventing illness or injury in the workplace,"[2] reveals mining medicine researcher Megan Clark, who outlines the following 7 common health risks to watch out for in the mining industry: dust [15], noise [13,14,15], vibration [16], UV exposure in surface mines, Musculoskeletal disorders, thermal stress, chemical hazards (gases and dust) [9,10].

Management must not only provide their workers good H&S practices at work, but also to enable and involve them in training for the proper usage and continuous improvement of these practices [6].

Sasa mine, having in mind the importance of health and safety working environment, focus on educating and explaining HSE rules and regulations to workers, contractors, as well as utilizing industry experience to implement such standards.

BACKGROUND

Sasa mine dates back to the 17th century. First geological investigations of mine site began in 1954 when the first elaborate for geological and ore reserves in Osogovo region was prepared. In the period 1960/61 a decision was made for construction and opening of a mine that lasts until 29.11.1966 when the mine is put into production, with an annual production capacity of 300,000 tons of dry ore.

After the sale, in 2005, Sasa mine began with its renewal. New equipment, ie mining machines from the world's leading mining equipment company Atlas Copco, was purchased, and new equipment from the world manufacturer of appropriate Metso Minerals technique was installed, existing equipment was repaired, and new facilities were built that was necessary for normal operation of mine and all started projects were realized until the mine restarted. On June 12, 2006, the Sasa Mine was officially released in full-time operation and first quantities of lead and zinc concentrate were produced, thus launching the new history of Sasa Mine. With great capital investments, Sasa mine has been transformed into a one of the most modern underground lead and zinc mine in Europe and the largest in the Republic of Macedonia.

After re-launching and modernization, the mine has grown into one of the most modern mining companies in Europe and has seen further positive development with an average annual production of about 770,000 tons of dry ore. Last several years Sasa mine continuously is entering the top 10 most successful Macedonian companies. In last 3-4 years, additional means has been invested in equipping and replacing the old one (purchased in 2006-2007) with new underground equipment (underground trucks, drilling equipment, LHD loaders) that is the latest generation and meets the highest safety standards [3].

The company's management is certified with ISO 9001 Quality Management Standard, implemented in 2008, properly maintained and regularly recertified by the Slovenian Institute of Quality SIQ-Slovenia. Environmental management system is implemented in accordance with ISO 14001 standard, which has been applied in Sasa mine since 2007 and in April 2008 was also awarded a certificate by SIQ-Slovenia. OSH management is implemented in accordance with BS OHSAS 18001: 2007, which is applied in Sasa mine from June 2014, when SIQ-Slovenia is awarded. In February 2017, Sasa mine successfully renewed certificates for all three standards through SIQ (Slovenia), a body accredited by the International Accreditation Forum (IAF).

But ......? Mining is a risky business !!!

From the begin of restarting SASA mine, in 2006, in addition to all efforts and compliance with regulations, H&S condition becomes a major problem in mining operation. Since the re-start of the mine by mid-2013, there have been eight fatal accidents (caused by several factors), such as: breakdown, standing in unsafe places, uncontrolled access to hazardous areas, falling materials, fall from height.

In the same period, on average, approximately 25 injuries per year are recorded, and as main reasons there are: negligence, violation of procedures / obligations, inadequate hazard control / unexpected hazards` exposure.

METHODS FOR IMPROVING SAFETY

Faced with the upward trend of injuries, in 2011, Sasa`s mine management, complete reorganization of health and safety system was initiated, based on principle of "0" tolerance across 4 main topics:

1. Reorganization of roles and responsibilities and introduction of formal H&S system (OHSAS 18000)
2. Full harmonization of H&S measures with legal provisions (100% without justifications and deadlines).
3. Improve working conditions, equipment and tools.

4. Improve training of staff through a full introduction of regulations, rules and guidelines for safety working [7].

Improve Training!

Improving OSH training involve, continuous monthly trainings on rescue squad, first aid training, emergency response training, training for handling explosive materials, as well as OHS training for workers. Continuous monthly trainings for underground mining equipment operators were conducted and its maintenance by equipment manufacturers.

Harmonization with legal regulations!

Risk assessment and OHS statement for all workplaces was prepared [11,18]. Periodic measurements of exhaust gases, ambient air quality in underground site and industrial site, as well as personal exposure to certain hazards are performed. It operates exclusively in accordance with approved technical documentation from Ministry of Economy, with permits for use new equipment, including equipment directly intended for implementation of safety measures and increased safety in underground site and outside. Regular medical examinations are carried out by an authorized medical institution.

H&S systems!

BS OHSAS 18001: 2007 (certified by SIQ June 2014) was introduced, so Sasa is unique mine with this certificate in the region. The number of workers / engineers in OHS Department has increased. System of periodic (weekly) continuous OSH meetings was introduced.

System for punishment of managers and workers - violators of H&S regulations has been introduced. Performing of any extraordinary work during the night shift and without presence of responsible person is forbidden.

Improve working conditions and equipment!

A new improved ventilation system on underground site was introduced and a main ventilator was dislocated [17]. Raise boring machines have been introduced for raise construction between all horizons, for ventilation of underground rooms, as well as for storing and transporting ore and waste rock. New transportation system with trolley locomotives on horizon 830 has been introduced. Improved support system in underground site with Split Set Stabilizer and shotcrete has been introduced; usage of a wooden support is reduced to a minimum. Nonel blasting system and emulsion patronized spraying was introduced. Old mining equipment has been replaced with new (underground trucks, drilling equipment, LHD loaders), the latest generation that meets highest safety standards.

Improve active H&S!

In 2016, Sasa Mine starts implementing new OSH Strategy [4]. Strategy`s Objectives as follows:

1. Continuous improvement of OHS hazard recognition and management during working activities.
2. Continuous reduce the number of injuries and occupational diseases as well as their severity.
3. Preventing fatal accidents.
4. Application and improvement of Integrated Management Systems based on ISO 9001: 2015, ISO 14001: 2015 and OHSAS 18001: 2007 standards.
5. Harmonization on General Guidelines of Environmental Protection and OSH and Guidelines for Environmental Protection and OSH in Mining in accordance with Law on Mineral Resources with those of the IFC Group / World Bank referred by the Equator Principles from June 2016.
6. Fulfill all other set goals in Sasa's S&H Policy**.**

Compulsory prior to commencement of working activities, Job Safety Analysis, as well as, 5 steps to Safety Work Worksheets have must completed.

Job Safety Analysis is a simple risk assessment technique that focuses on work tasks as a way of identifying hazards and controlling their risks. The focus is on relationship between worker, task, tools it uses and working environment. Usually results in a written document that is used to standardize the task, for example, Standard operating procedure (SOP) that points to several problems related to task, for example, process, specifications, materials, time, quality, costs, etc [5].

Five steps to Safety work Worksheet involves these steps: Stop, Think, Determinate, Plan, Continue. The worker looks round workplace regarding the Safety, if identified risks, plan and take measures for their removal, and even then continues with working activities.

According to H&S Improving Strategy, new initiatives in 2016 were introduced, as follows:

- Permit for hot work;
- Compulsory Alco test for workers and all contractors in mine;

- Risk assessment via "5 Steps to Safety Work" Worksheet ;
- Preparation of Control Sheets for Planned Observations of Work Tasks;
- Ongoing development of Basic Mining Danger Management Plans.
- Continue with increased controls by the H&S Department and reduction of observed safety offenses (unsafe conditions and practices).

In 2017, following new initiatives have been implemented:

1. Preparation of Job Safety Analysis with all contractors as well as for those working tasks for which no standard operating procedures or appropriate instructions have been developed.
2. Reduction of mechanical hazard / regarding moving equipment (minimum distance 2 m from moving equipment).
3. Improved training of workers and their skills for identifying hazards by upgrading and harmonizing the training with established hazard and risk assessment registry at Sasa.mine.
4. Development and implementation of 43 new Standard Operating Procedures (SOP).
5. Planned monitoring of working activities for all 43 SOPs has been introduced.
6. Investigation of high-risk hazards.

Planned monitoring of working activities presents structured worker` monitoring by all liable managers. Liable manager checks knowledge and compliance with Standard Operative Procedures and gives corrective feedback to the worker when he notices unsafe practices. All liable managers are required to monitor, to improve their personal leadership capability and to incorporate safety practices. Investigation of high-risk hazards presents a structural investigation of the causes, consequences, and other factors in observed unsafe conditions and practices. All liable managers should carry out such a hazard investigation to improve personal identification of hazards and expertise for safety working practices.

In order to verify improvement process of OSH system in Sasa mine, specialized Nordic Safety Climate Questionnaire (NOSACQ-50) was distributed to different groups of workers, primarily with the focus on underground personnel.

A specialized Nordic Safety Climate Questionnaire (NOSACQ-50) is a tool for diagnosing the safety environment and assessing the effectiveness of safety systems. There is a strong scientifically proven link between safety environment and performance of safety systems (low level of injuries).

This questionnaire has been tested in various industries and its validity and reliability has been proven in the Nordic countries. The questionnaire is partially modified to test the trend of changing the safety culture.

Nordic Safety Climate Questionnaire (NOSACQ-50) was developed by a team of Nordic occupational safety researchers based on organizational and safety climate theory, psychological theory, previous empirical research, empirical results acquired through international studies, and a continuous development process. Safety climate is defined as workgroup members' shared perceptions of management and workgroup safety related policies, procedures and practices. NOSACQ- 50 consists of 50 items across seven dimensions/ categories [8].

The questionnaire defines 7 categories that are evaluated. For a positive assessment is considered 2.5 score, while 2.5 to 3 means good.

Table 1: 7 categories that are evaluated through NOSACQ-50 [8]

1	Management safety priority, commitment and competence
2	Management safety empowerment
3	Management safety justice
4	Workers' safety commitment
5	Workers' safety priority and risk non-acceptance
6	Safety communication, learning, and trust in co-workers' safety competence
7	Workers' trust in the efficacy of safety systems

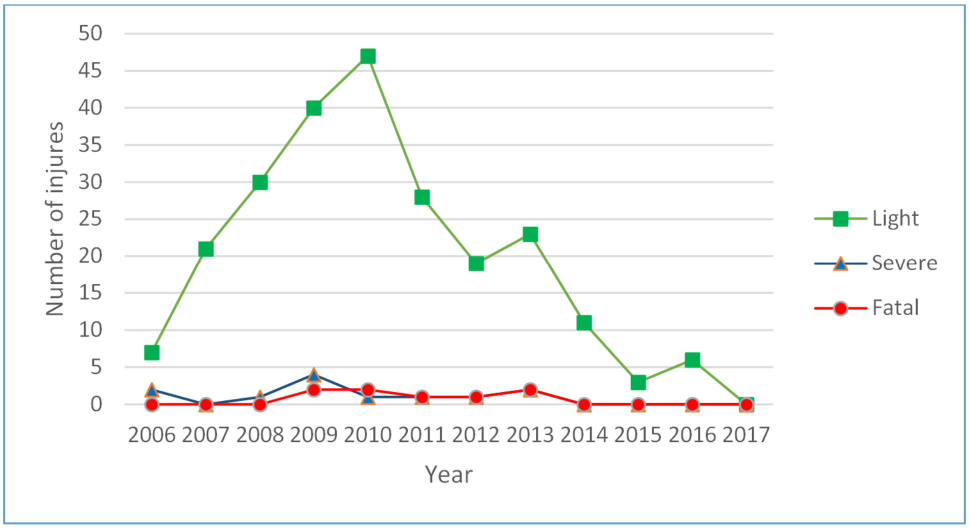
RESULTS

Different groups of workers were analyzed, primarily with the focus on workers in underground site. The data indicate that in 4 categories, situation that was negative before 2011 is in a positive zone, now. In the other three have further improvement with a special emphasis on good communication and training system (with score over 3).
Motivation of management and the ability to motivate are also highly valued. In other categories, there is prospects for improvement, especially in the acceptance of risks and unsafe conditions by workers.

Real and sincere desire to increase capacity and improve performance in terms of safety management gave expected results:

- Significant reduction on number of injuries from re-starting the Sasa mine to date (Figure 1).
- 2017 has been finished with 0 light, severe and fatal injuries.
- 483 days continuously without injury during 2017 to date (Figure 2).
- Risk awareness has been built up, and reduced tolerance to unsafe conditions and actions.
- "Thinking" about safety is on a higher level.
- There are striking benefits regarding the technology improvement and upgrading of equipment as well as working conditions.

Figure 2. Trend of injuries in Sasa Mine during (2006-2017)



Source: own source

Safety awareness in SASA mine has been raised to the highest level and all workers have aware of importance of applying all safety measures while performing working activities. All workers in SASA mine are involved in increasing safety level through holding safety meetings, also they are aware that:
NO ONE WORK IS NOT SO URGENT TO BE PERFORM ON UNSAFE MANNER

Table 2. Key safety statistics for 2017

Key H&S statistics	**Quantity**
Number of days since the last injury with sick leave	431
Number of total recorded incidents – monthly / by the end of 2017	0/0
Number of injury with sick leave – monthly / by the end of 2017	0/0
Lost working days due to an injury at work – monthly / by the end of 2017	0/0
Total working hours of contractors without injury with sick leave for 2017	368,664
Total working hours without injury with sick leave to the end of December 2017	1.410,792
Number of incidents (with first aid/ or equipment damage) for 2017	05/02
Number of incidents with high incidence potential	03

DISCUSSION
Sasa mine, after achieving outstanding results in H&S Management, continues with improving H&S Policies, including:

- Improving skills for hazard identification and risks non-acceptance.
- Improving risks analysis and safety rules.
- Improve the safety of all equipment.
- Integration and automation of H&S management systems.

Key Safety Initiatives for 2018

- Strengthening Key Capabilities in Functioning of H&S Management System;
- Audit program for critical controls;
- Merging the SASA H&S System with Contractors Management;
- Preparation of detailed Emergency Plan [12];

- Preparation of annual plan for H&S topics by months;
- Development of monthly plans of H&S topics;
- Installation of automatic fire-fighting system at key point in underground site, for example Explosives Warehouse;
- Training workers in underground site for usage of new mining self-helpers.
- Training of all Supervisors for detailed investigation of incidents or potential incidents in which a worker could be injured or greater damage to equipment or the environment through a standardized documentation.
- Upgrade the existing legal health monitoring program to align the classification of health issues and reporting with modern approaches, according to the International Council on Mining and Metallurgy.

CONCLUSION

Although mining is one of the most risky industries, the Sasa mine example shows that application of good safety practice as well as unconditional commitment of Management and all workers, using "we can always do better" approach can maked difference and gave positive example as mines can be a safety place to carry out working activities. The goal of Sasa mine is continuous improvement of H&S situation through the introduction of various control tools. H&S enhancement is an open process that does never ends, always, there is chance for its improvement. H&S Improvement Strategy is structured approach to the implementation of internationally recognized good practices in H&S management, taking care not to override the existing systems and safety approaches that exist at the moment in accordance with requirements in Macedonian legislation.

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LOG-METHOD: A NUMERICAL TOOL IN CULTURAL HERITAGE RISK & RESILIENCE MANAGEMENT

Abstract
LOG-method is a simple and smart numerical tool, devised for assessing, monitoring and managing risks and resilience as part of the heritage protection projects in large cultural institutions, such as large museums, archives, restoration facilities and libraries. The method encompasses elements of both risks and resiliency of the cultural collections and systems maintained by a given complex institution. The LOG-method, due to its robustness, may not be entirely adequate for application in small or simple heritage protection projects, but it may find application in large projects in principle similar to the protection projects in the field of culture. From the analysis of the risk and resilience components, the log-method derives an indicator of readiness of the institution to the identified cumulative threats. Focus of this numerical method is measurement of readiness trends and providing reliable numerical tool of measuring improvements. By influencing the critical parameters of risk and resilience, the organization may observe the direct correlation between its investment in risk mitigation and resilience enhancements, and consequently in the level of particular and general readiness in relation to the identified threats.

Keywords: numerical method, risks, resilience, readiness, disaster management.

INTRODUCTION

Risks assessment for the collections and heritage of the complex central institutions in culture inevitably leads to consideration of most varied regulatory, statutory, administrative, logistical, cultural material, and security, as well as intrinsic, internal and external threats.

This multidimensional and all-encompassing approach may on one hand induce strong calls for simplification of the risk/resilience assessment model and reduction of scope, but on the other it offers the multitude of practically relevant variables, which may produce not only quality results, but also encourage a comprehensive consideration of risks and resilience elements related to the institution, and the related sector(s).

Much of the current work in risk assessment in the field focuses on the threats and risks, and less so on the resilience elements, while they are closely tied together for any given threat and protected item/system. By quantifying and combining the considerations of risks and resilience elements, produces a numerical measure of system's readiness for large incidents and disasters.

The LOG-method provides a simple and robust numerical method for quantifying risks and resilience elements, it is scalable and adaptable to institutions in culture and in principle similar organizations, and ultimately it may employ discrete, more precise rational, or combined variable values, which are produced in either rapid ad hoc, or more detailed and extensive assessment process.

THREATS AND PERCEPTION: INTERDISCIPLINARY APPROACH

In the recent seven years there have been very important and ground-breaking developments in understanding what constitutes the emotion of security, which strongly influences how are threats (not) perceived, and what measures and actions follow.

In her recently published work Feldman Barrett (2017) has postulated the theory of constructed emotion, stating that the emotions are socially or culturally constructed through the mechanism which involves interplay of interoception, concept and social reality.

Building on the abovementioned theory, Tkalec (2018) applied its postulates in the interdisciplinary field of cultural diversity, considered through the combined lens of the heritage studies and security studies.

The conclusions following from this application suggested that security and heritage are defined in the same space of constructed emotions, thusly understanding their interplay is key to understanding and managing the convergence trends of corresponding cultures and the related societies/groups. Moreover, the emotion of insecurity is generally transferred across generations, it may become integrated into a culture, and may influence the social reality. Furthermore, the main component of cultural/ social resilience (as applied to both the protectors, and threats as identified by them) is originally a non-technological item – but the interpersonal faith in reliability and integrity within a culture. These circumstances may direct affect which and how threats are being assessed, and which (technological, organisational and pre-emptive) measures are considered and put into effect. (Tkalec, 2018)

The above ultimately implies that in identifying threats and conducting the risk and resilience assessment for any organization/system, a wider and interdisciplinary (social and humanistic, as well as technical) understanding of security components and considerations need be employed, as to adequately interpret the truths that are relevant to the system. Since security studies, as well as heritage studies, each by itself represent a strong and closed formal system, this proposition may also be considered as a reincarnation of the Tarski's undefinability theorem, or the Gödel's incompleteness theorems, rendering multi-disciplinary approach instrumental in reaching a more complete understanding and proactive management approach to security.

In any case, advanced study of security, as a function of risks and resilience of cultural systems, merits consideration through its many faces, including and overarching the technical, social or humanistic sciences. For this reason, methodology for identifying threats and evaluating their potential influence on the system will be a matter of a future paper, while this one will solely provide a numerical, technical tool to quantify and manage risks and resilience components, and consequently measure the system’s readiness to survive large incidents and disasters.

LOG-METHOD

Original variables in risk and resilience assessment

The LOG-method requires that any of the identified (non-null) threats is considered independently and individually, directly in relation to the protected item/object(s), be that a heritage building, site, collections, holdings, or a composite.

The model from the perspective of the protected item/object(s) considers two basic aspects for each identified threat:
RISKS, which assumes that in relation to each identified threat there are three elements of risk assessed: intensity of threat, exposure to threat, and vulnerability to threat; risk is a measure of events’ effects that contribute towards the divergence of the system,

RESILIENCE, which assumes that in relation to each identified threat five elements of resilience are assessed: robustness, redundancy, resourcefulness (or adaptability), response (or ability to react) and recovery (or ability to recuperate) (Mihaljević and Toth, 2008), from the perspective of the protected item/object(s); resilience is a measure of events’ effects that contribute towards the convergence of the system. (Tkalec, 2013)

Original assessment variables
The assessment of original assessment variables assumes assigning each element of risk, and each element of resilience, a numerical value of 1 (least), 2 (medium) and 3 (high), denoting discrete levels of estimated risk and resilience level for each of their above listed components.

This assignment of values 1 to 3 to all original assessment variables normalizes the overall assessment, and makes the further computation possible, results measurable, and interpretation of the results and action in response to the interpretation manageable.

The assessment values at this level are generally assigned from the set of only three discreet values (1, 2, 3) as to discount human limitations in providing a more refined differentiation of complex and composite variables, thereby contributing towards the reliability of the assessment, at the expense of its precision.

However, a more precise assessment, introducing rational values, is also achievable by introducing a more differentiated and specific threat/ risk/ resiliency assessment, e.g. a specialised, refined questionnaire for a specific section of protected object, a composite risk/resilience element, or some otherwise considered complex aspect of assessment. By employing and scaling the core assessment principle of the LOG-method, a more precise and verifiable assessment may be produced. Also, it remains to be seen if this would also influence the reliability of assessment to any significant level, since, however detailed, it would remain a function of human informed and guided estimated.

METHODOLOGY

Assessment of the original variables of risk and resilience is to be done as objectively as possible, preferably by three of more auditors independently, following neutrally articulated and intrinsically reliable questionnaires and protocols, subsequently normalizing the accumulated response, and resolving any peaks and aberrations. The reliability of assessment of the original variables may be improved (and circumstances monitored) by regular annual reviews of tools and protocols used.

The identified threats, and related risk and resilience elements, may be differentiated to the level of preference of the client, and presented in a report in detailed and/or cumulative form.

The LOG-method is likely to be more reliable when numerous threats and protected elements are considered, and several diverse auditors engaged to cover same assessment areas, as increased numbers work in favour of diluting any biased inputs.

These identified threats may further be organized in their natural groups, with careful and farsighted consideration of their real impacts. For example, groups of threats may address the following areas (per both sources and protected items relevant to the organization): legislative, regulatory, statutory, administrative, logistical, human resources, equipment, emergency services, collections & heritage, environmental, and other.

There could also be other alternative (or parallel) axis of threat identification, consideration and assessment, such as intrinsic, internal and external threats, which may be than further elaborated, as to the preference of auditors or clients.

If the assessment of original risk and resilience variables is in line with above suggestions, there should be no additional weights or corrections employed, and none are recommended in this method. Any such weights need to be considered in assessing the individual original variables, in relation to both the considered element, and other variables.

LOG-method	Risk assessment (1 = lowest; 2 = middle; 3 = highest)			
Threat description & source	*intensity*	*exposure*	*vulnerability*	*RISK index*
	[orig. var. I_j]	*[orig. var. E_j]*	*[orig. var. V_j]*	*R_j*
Threat 1	2	1	3	54%
Threat 2	3	3	3	100%
…	…	…	…	…%
Threat j	3	2	3	88%
…	…	…	…	…%
Threat n	3	1	1	33%
Arithmetic mean	…	…	…	… %

Table 1: Example of numerically assessed original variables for risk components and result for the corresponding risk index R_j.

LOG-method	Resilience assessment (1 = lowest; 2 = middle; 3 = highest)						Readiness index
Threat description & source	robustness	redundancy	resourcefulness	response	Recovery	RESILIENCE index	
	[orig. var. $S_{1,1}$]	*[orig. var. $S_{2,1}$]*	*[orig. var. $S_{3,1}$]*	*[orig. var. $S_{4,1}$]*	*[orig. var. $S_{5,1}$]*	*O_j*	*T_j*
Threat $_1$	3	1	3	2	3	73%	37%
Threat $_2$	3	3	2	3	3	93%	28%
Threat $_3$	3	1	3	3	3	80%	28%
…	2	2	2	2	2	63%	46%
Threat $_n$	3	2	3	1	1	53%	18%
Arithmetic mean	…	…	…	…	…	… %	… %

Table 2: Example of numerically assessed input original variables for resilience, and result for the corresponding resilience index O_j, and the projected readiness index T_j.

CALCULATION OF INDICATORS

The assessment of the risk index R_j related to the threat *j* is given as percentage by the formula:

$$R_j(\%) = \frac{log_3(I_j * E_j * V_j)}{3} * 100$$

where

$I_j \in [1, 3]$ is a numerical assessment of intensity of threat j
$E_j \in [1, 3]$ is a numerical assessment of exposure to threat j
$V_j \in [1, 3]$ is a numerical assessment of vulnerability in relation to threat j,

under condition $(I_j * E_j * V_j) > 1$, which ensures that the considered threat is real and existing, and consequently $R_j > 0$.

In a similar way, the resilience index O_j is given as percentage in relation to the threat *j*:

$$O_j\ (\%) = \frac{log_3[X_{1,j} * X_{2,j} * X_{3,j} * X_{4,j} * X_{5,j}]}{5} * 100$$

where

$X_{1,j} \in [1, 3]$ is a numerical assessment of robustness in relation to the of threat j
$X_{2,j} \in [1, 3]$ is a numerical assessment of redundancy in relation to the of threat j
$X_{3,j} \in [1, 3]$ is a numerical assessment of resourcefulness in relation to the of threat j
$X_{4,j} \in [1, 3]$ is a numerical assessment of response in relation to the of threat j
$X_{5,j} \in [1, 3]$ is a numerical assessment of recovery in relation to the of threat j,

under condition $(X_{1,j} * X_{2,j} * X_{3,j} * X_{4,j} * X_{5,j}) > 1$, which ensures that the considered resilience element is real and existing, and consequently $O_j > 0$.

These two indices are further combined to provide an index of readiness T_j of an observed system/organization to the threat *j*, considering risk $R_j \neq 0$ associated with the threat *j*, and the corresponding resilience O_j:

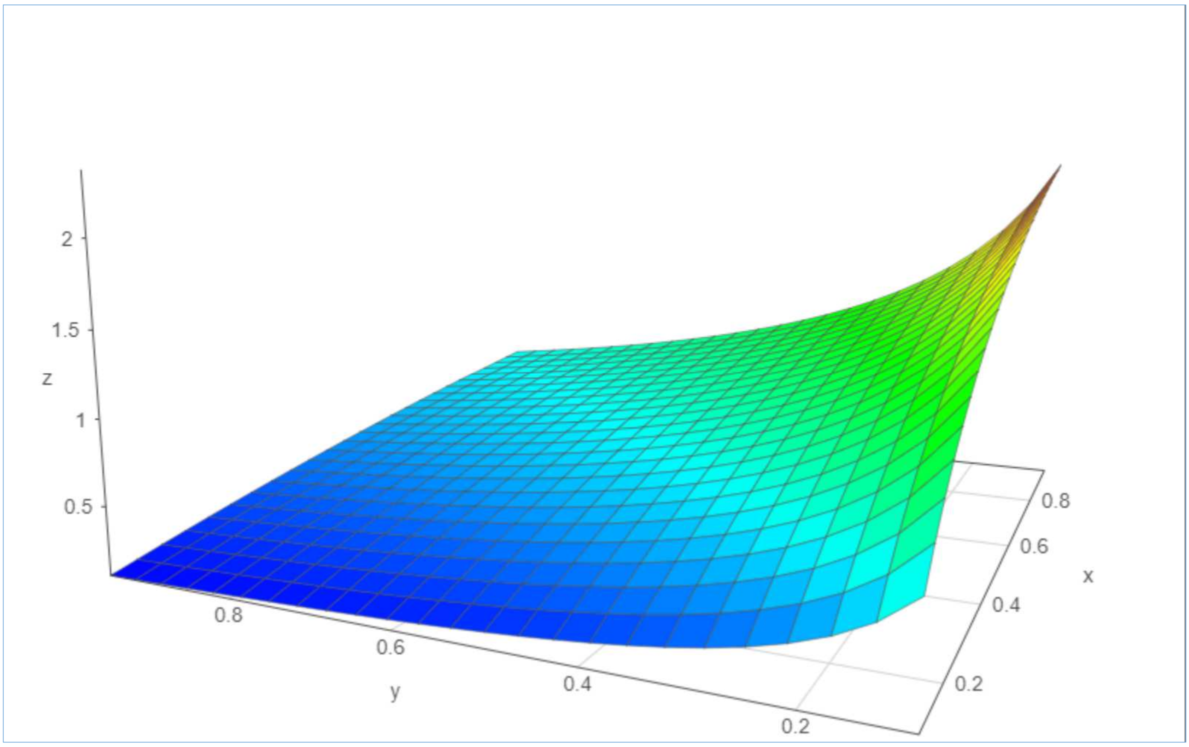
$$T_j(\%) = \begin{cases} 100, & \log_{10}\left(\frac{O_j}{R_j} + 1\right) \geq 100 \\ \log_{10}\left(\frac{O_j}{R_j} + 1\right) * 100, & \text{otherwise.} \end{cases}$$

Depending on the project parameters, assessment results may be logically grouped, and group arithmetic mean for each of the element of risk, and each element of resilience, may be calculated to produce a group risk and resilience indices, again preferably without the assigned relative group weights, as the weight for each threat should be anticipated in the estimated original variable values.

Analysis of the numerical method
Graph 1 bellow provides a graphical representation of the readiness function T_j ($R_j \neq 0$, O_j), where the two composite variables are risk index $R_j \neq 0$ shown on the horizontal y axis, and the resilience index O_j shown on the other horizontal x axis.

The surface shown on Graph 1, illustrating the noted function T_j (R_j, O_j), is convex, since T_j (R_j, O_j) is continuous, monotonic composite function in the interval $R_j \times O_j = (0,1] \times [0, 1]$. This is consistent with the risk/resiliency assessment reality and serves the management purpose of the method. Likewise, the functions $R_j \neq 0$ and O_j are also continuous, monotonic functions in the intervals of definition of their respective variables, as elaborated above.

The limitation of the above graphical representation method is that it requires 9-dimensional input to be presented in a 3D representation. For this reason, the representation was reduced to the attainable 3-dimensional representation, where the horizontal plain axis represents the risks and resilience estimates as inputs, and the resulting readiness estimate is on the vertical axis. The three values are expressed as percentages.



Graph 1: Graphical representation of the monotonic continuous function $T_j(R_j, O_j)$ (z axis), in the interval $R_j \times O_j = (0,1] \times [0, 1]$ (x and y axis). The graph illustrates the functional relationship between the risk and resilience indexes. This graph was generated using online 3D Surface Plotter program available at https://academo.org/, 9 February 2018.

From the functions and the corresponding curve, one may conclude that the 100% readiness is achievable for a set of low risk and high resilience indices, which means that satisfactory readiness (as per this method) may be attained in various constellations of risk and resilience aspects. On the other hand, zero readiness index is achieved for a combination of 100% risk and zero resilience only.

Interestingly, in case of 100% risk index and 100% resilience index, only 30% readiness level is achievable. This method therefore assumes that for 100% risk index (maximum intensity, maximum exposure, and maximum vulnerability) there can be only 30% readiness in any given case, regardless of the maximum resilience. This numerical result may be debated, however in consideration of all the unknown and unanticipated effects that accompany any disaster or large incident, including cascading risks, the result is an acceptable, informed assumption.

CONCLUSIONS

The LOG-method provides a simple and robust numerical tool to measure risk, resilience and the resulting readiness indices, as function of nine original risk and resilience variables pertaining of each of the identified and considered threats. This method does not provide methodology for assessing the elements of risk and resilience but provide wide guidelines which should be followed in assessment, to serve the intended purpose.

The method is completely scalable and is best suited for complex organizations or projects in the sector of culture, or the similar in principle, in that it requires a relatively static environment, such as collections, heritage and other stabile cultural holdings or processes.

The method may be applied using a simple three discrete original assessment variables (1, 2 and 3). However, by developing questionnaires and/or protocols for a more elaborate assessment of certain or all specific threats, it may also use rational variables, which could produce more precise results, whilst reliability may be enhanced asymptotically by increased number of considered items, and their auditors.

The LOG-method may be a useful tool, but users should be aware that numerical representations require adequate interpretation, always anew considering specific circumstances. The results of the method are limited in that they are not absolute measure of risk or resilience, but relative.

The consistent application of the simple and robust LOG-method may provide a tool in monitoring comprehensive risks and resilience elements, as well as explore ways in which they contribute towards the system's or organization's readiness to endure large incidents and disasters. Also, systematic consideration of these risk and resilience as proposed by the method may also serve as a useful tool in tackling the mentioned readiness aspects, by creating and benchmarking short to long term plans to increase systematic readiness.

Finally, tackling the construction of the emotion of security, and perception of what makes environment secure for a society and individual remains the ultimate challenge in assessment and management or risks and resilience. Recent ground-breaking developments in interdisciplinary scientific disciplines of security and heritage suggest that its resolution is in cross-disciplinary approaches and exchange.

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Subject review

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MANAGING PROJECTS IN THE FIELD OF ENVIROMENT AND LIFE QUALITY

Abstract
We are witnesses that in today's time the field of environment is becoming more and more important, because we can hardly talk about some certain future if this problem does not get its due attention. The first step starts with the need for the key factors, which present risk for our environment, to be identified. By identification of the risk, preconditions for clear defining of the problems, that are the subject of our studies, are made. Observing the problem, establishing its' basic characteristics and defining of potential solutions demand clear management with those activities. Without the clear management of the problems we can hardly come to the appropriate solutions which should improve the already existing environment. The logical question that imposes itself, as a component part of observing the problem of environment, is the question of life quality. Can we talk about life quality in endangered environment? It is clear we cannot talk about life quality in polluted environment. The starting hypothesis of this paper goes from the premise that without managing the project about environment we cannot speak of good life quality. Descriptive method and study of available literature, both domestic and foreign, and also studying of examples of good practice, have been used in this paper.

Key words: Managining projects, quality, risk

INTRODUCTION

It is evident that the issue of the environment becomes a matter of all issues and if we want to talk about a certain future, we need to pay a lot more attention. If we take a look at national governments, it is easy to see that in the majority of countries there are special ministries that are dealing with the environment. It speaks volumes of the fact that the environment is a very important issue today as well as in the following time. The issue arises when certain measures need to be implemented in practice, because the price of adapting existing technologies and changing them into "clean" technologies is often expensive and requires significant financial resources. The question is whether we have the alternative and how much time we can buy by behaving in the way we are now behaving. It is clear that the environmental issue is recognized both globally and locally. When it comes to a global level, there are numerous documents and conventions that are dealing with attempts at creating a legal framework for the environment due to which a better and more certain future would be created. However, it is precisely those who produce the highest level of pollution, even though they officially support the legal framework due to which there are attempts at creating a better future, in practice, they do almost nothing on this issue. "Dirty technologies" are moving away from their surroundings and through a mantle to help underdeveloped countries they transmit those technologies to those countries, creating enormous problem and often causing numerous environmental disasters. The fact and some kind of "justice" when it comes to the environment is that the environmental issues cannot be observed locally but globally. Often, environmental problems cannot be limited to specific territories. For this reason, developed countries, which are moving away their "dirty" technologies to least developed and underdeveloped countries, cannot completely dislocate themselves from the consequences of the use of those technologies. The best example is the end of 2017 when we clearly see what is happening in the USA, one of the biggest polluters, when it comes to snowy weather conditions. If, at the global level, there is no clear awareness of the need to create better environment, what can we expect at the local level? Common legal practice starts from the tendency to adopt certain convention at global level or other legally binding acts at international level, which are subsequently confirmed in national parliaments and on the basis of which certain legal acts and by-laws are adopted. These acts entail certain obligations, for both legal and natural persons.

It is clear that, if there is no legal basis, we cannot expect a lot from the culture of protection of the environment, especially in less developed and poor countries. Underdeveloped countries wholeheartedly accept foreign investments in "dirty" technologies and by justifying it as the need for greater employment of local population they become an active participant in the process of creating poor living environment on their territory.

Because of all mentioned above, a lot has to be done regarding the legal regulatory environment as well as in recognizing risky situations which cannot be left to the chance, but it must be actively managed in order to minimize potential negative consequences. Potential environmental risks are numerous and they are present in the pollution of soil, water and air. Every segment of that pollution, to a greater or lesser extent, and depending on the territory, is reflected on the quality of life. It is clear that there is a tendency to lift the quality of life every day step by step, but in the existing environment it is becoming more difficult to speak about the quality of life and its certainty in the following time. The term quality of life is new in social sciences (it appears in the second half of the 20th century) and occurs at the time when positive as well as negative consequences increased of industrial and technological development. Under the conditions of the ecological crisis, there are doubts that there is a possibility of lifting the quality of life in industrialized countries. Together with the issues of human existence, the quality of life and the environment in which people live, it is becoming common to notice the facts that the way of life production, as the basis of modern civilization, produces and creates problems of pollution and ecosystem degradation which will have incalculable consequences for the human population. Creating a better living environment cannot be only reduced to the change and application of a technique, but also to change the way of production, i.e. organization. It means that social, economic and political structures, and especially everyday life, need to be changed.

This implies that there is a need to recognize risk factors and through the overall activity, it aspires to perceive them and create an environment for reducing the negative impacts of these factors on the quality of life. In such an environment, there is inevitably the need for managing projects which will, while observing, focus on risky environmental factors as well as the fact that through an active and continuous process of risk assessment, preconditions will be created for a better understanding of the role of the environment in the quality of life of each individual. The ability to define and plan the solutions will be obtained through the establishment of systems of the quality and standardization by establishing preventive measures and introducing supervision, as a lasting action of the plan:

- Environmental risk assessments, environmental impact assessments of environmental effects, environmental risk modeling, integrated environmental monitoring, environmental risk management and the creation of environmental management systems;
- Prevention of all negative human activities (especially production) that have a significant impact on natural ecosystems, together with the control of the environmental performances of organization, institutions and companies;
- Effective implementation of corrective actions in cases where the balance has already been disturbed;
- Effective process of decision-making that regulates the impact of human activities on natural values and resources, taking into account that the capacity and potential of the environment for sustainable human development are not disturbed through timely and efficient identification, planning, implementation and monitoring of corrective measures and overall environmental protection regulations. [8]

What is a really noticeable problem is the question of competent experts in this field because we think that there is an insufficient number of them and that it speak volumes of the need for multidisciplinary approach of several different experts in the process of creating a better environment, risk assessment and definition of an appropriate approach that will create preconditions for a clear understanding of the environmental issues.

THE CONCEPT OF THE ENVIRONMENT

The environment or human environment represents everything that surrounds us, i.e. everything that directly or indirectly man’s life and productive activity is connected with. Environment is a specific resource for the emergence, development and survival of human life and its pollution represents a need to a certain extent. Pollution is not performed only by a man while meeting his needs, but also by other living beings as well as by the nature itself in some of its activities (volcanic eruptions, earthquakes).

We cannot have an effect on the nature, but we can and we have to have an effect on a human factor. In recent decades, pollution has been perceived as a serious issue that endangers the development and survival of man, and it calls into question the existence of the future.
It has been a long time since scientists were the only ones who have dealt with ecology, or better to say with environmental issues, as well as when they have discussed the consequences of human activities on the environment at academic conferences. Every resident of the planet is surrounded by environmental issues today, and the consequences are noticeable daily, through air we breathe, water or food we give to our organism, through the pollution and radiations we are exposed to. What about the natural resources that nature has given us? In time of intense exploitation of existing resources, increasingly complex ecological issues appear that are manifested through smaller and smaller amount of natural resources, through the extinction of plants and animal species, as well as disorders in global ecosystem and biogeochemical process. The population of the planet is constantly increasing which means that the need for urbanization and economic development, food, is also increasing. Where is the border beyond which life on Earth is no longer what it was or is?
Building and expanding cities is occupying more and more space and in order to meet growing demands for production and consumption, more and more natural resources are being used. A large part of natural resources, which are commonly used for human activities, is non-renewable. In the past, it was believed that global resources, which represent the source of energy, such as water, ores, oil, natural gas, minerals, will never be expended. Today, taking into account the economic development, we can come to the conclusion that global reserves of these resources are nearly depleted. What to do next? The environment is a set of natural and created values whose complex interrelationship is making up the environment, i.e. space and living conditions; these are all conditions, circumstances and influences that surround and affect the development of one organism or a group of organisms, the effects that come from both living and non-living things. The environment is consisted of a world of nature (plants, animals, land, air and water) which have existed for millions of years before a man and the world of objects and things and institutions that man himself has built using techniques, technology and science in order to create the environment that suits his needs and aspirations. The environment or human surrounding represents everything that surrounds us, i. e. everything that is directly or indirectly connected to a man's life and productive activity. The natural environment represents a close concept where there is no need for the activity of a man nor that the man has to have a direct influence on it. Nevertheless, in terms of technological advancement, industry development and the increasing impact of a man on the nature and ecosystems on a global level, the boundaries between these two are becoming increasingly blurred. During his activities, which can be urbanization or exploitation, a man changes the natural environment often by violating the natural environment.

By constructing hydroelectric power plants and accumulations, cutting of forests, by afforestation and exploitation of mineral resources, creating landfills, gas emissions and nuclear tests, etc., the man leads to a change of the entire areas. As a result of human activities, there are changes or disturbances of ecosystems and climate changes on local and global level. The environment can be perceived as a five-component system consisted of: atmosphere, hydrosphere, lithosphere, soil, organisms. [11] For each individual organism, the environment is a non-living nature, determined by conditions (temperature, humidity, soil pH) and available resources (energy, water, mineral elements), as well as a living nature, consisted of other living beings with whom it is in direct or indirect contact. In the environment, organisms find everything needed for leading a normal life, metabolic process, development, reproduction and survival. It is not always and everywhere generous to living beings, so they are often forced to lead a very difficult struggle for their survival. Particularly severe conditions are in the Arctic (low temperature, high humidity, constantly frozen ground) or desert (high temperature, extreme drought, undeveloped land) areas or other inhospitable areas, where resources can be found in minimal amounts and prevent organisms to lead a normal life. The environment is characterized by great variability and heterogeneity in time and space, which is the result of operation of constantly changing complex of ecological conditions. On certain organisms, a set of ecological conditions works differently, even differently at every stage of their development. In such an environment, a man with his needs is involved, and there is a gradual degradation of many things that existed on the earth's surface. The basic balance of everything that existed on the earth's surface is disturbed and we are more and more faced with the fact that it is much more produced than it can be decomposed in the nature itself, either naturally or artificially. Not until we became a consumer society, there were no problems we are facing today because what was produced in the nature could be largely decomposed and the life on the planet was much more certain. There are numerous risks that we must fight in the following time, from global warming, ozone holes, to everything that makes our lives on the planet Earth uncertain. Based on the nature of the pollutants, they are divided into inorganic and organic, and based on the physical state there are gas, liquid and solid. Based on ecology, i.e. due to the possibility of reducing pollution, there are two types of contaminants: non-degradable and biodegradable.

Based on the nature of the pollution, they can be divided into: pollution caused by materials, (e.g. chemicals and radioactive particles), energy pollution (e.g. heat and noise), and pollution caused by force fields (e.g. electromagnetic). Especially important is the question of the current moment and sustainable development which promotes different point of view of the following time. Sustainability will be absent in any area (regardless of the climate, biodiversity or trade) unless global binding agreements that respect environmental policy are reached.

ENVIRONMENTAL RISKS

There are different types of risks and, depending on what is in the focus of observation, we observe their basic characteristics which help us perceive them and take certain preventive measures. According to the international standard ISO 31000:2009, a risk is defined as an effect of uncertainty on the objectives. This definition as well includes both positive and negative effect on achieving objectives. The etymology of the concept of risk is very interesting. The concept of risk can be traced through history from the ancient Greek where it appears with the meaning of root, stone, cut of the firm land, and later it appears in Latin with the meaning of cliff or reef. The term “rizikon” is first used in Homer’s epic “Odyssey”, meaning sailing in uncharted waters, or as a difficulty of avoiding collisions at sea**.** We assume that in the world then, the greatest uncertainty was far-flung sailing in un-mapped seas. Thus, the term itself was also adapted in the central and western European regions and cultures through the Spanish and Portuguese sailors, developing together with the general social, cultural and scientific progress. What represents a certain kind of risk characteristic is the fact that it can be predictable and unpredictable. If we are able to recognize the risks, there are numerous methods which will enable us to validate and quantify them. After that, we can take some corrective measures. The problem lies in unpredictable risk which occurs suddenly and usually, there is a lack of time or often possibilities to manage it, and as a result there is no possibility to reduce the consequence of the risk itself.

When it comes to the environment, there are clear risks, both to the professional public and to the majority of the population on the planet earth. The question is whether we are ready to give up the consumer mentality and help in creating a better living environment. It is clear that there are serious health risks for the human population in the existing environmental system. Only the risk assessment process and environmental impact assessment on the human population encompass several different actions that should help in clear observation and recognition as well as in creating preconditions based on which certain measures will be taken. In each case, the first step should start from the assessment of the effects of the environmental impact on human health. In that way, it is necessary to determine what the key risks that can occur are and what negative consequences can appear as a result of a realization of these risks. Within this step, it is necessary to determine a dose of pollutants and an assessment of the expected effects (a response to intoxication), which includes the dose which is in the function of exposure and the occurrence, i.e. severity of the negative effects.

The second step is to determine, i.e. estimate the exposure which includes the determination of the concentration/dose of the pollutant which people (workers, residents) have been exposed to or which reached a certain environmental element (water, air, soil). The third step is the risk characterization which encompasses determining the frequency of exposure and severity of harmful effects that may occur in humans or among plants and animals depending on the measured or estimated pollution size. This is usually supplemented with a quantification of risks – the extent and probability of occurrence of harmful effects are determined. [2]

The risk for human health is most often defined as a probability that describes the degree of endangerment of the health of an individual exposed to the action of a certain pollutant or a group of pollutants. The amount of the harmful substance – the pollutant that enters the place of the exposure – is called a dose. Risk management is a multifunctional activity that encompasses an entire group of different areas, from economy, through natural sciences, biology to the legislative framework itself. Risk management is perceived while accomplishing several of the following goals:

- Identification, distribution and movement of pollutants;
- Assessment of the impact of pollutants on humans, i.e.

- Assessment of the impact of pollutants on characteristic ecological receptors, i.e. determination of the environmental risk and ecotoxic thresholds;
- Determination of the risk to human health;
- Designing and implementation of activities related to a renewal and purification of the polluted environment;
- Assessment of the harmful impact of certain pollutants on a given environment and for different recovery processes;
- Comparison of the existing risk with the expected risk before and after the recovery.

Risk and risky situations management requires a clear understanding of important steps that should help us in better understanding of the problem and, therefore, take the necessary measures with ease. The important steps are given in the figure 1:

Figure 1. Risk management and risk situations stages

Source: [2]

By analyzing the recognizable risks and looking for a way that will help in the process of their observation, it is necessary to observe the risk itself in several steps:

- Data collecting and processing
- Assessment of exposure and harmfulness and toxicity
- Characterization of risks, risk management and risk remediation.

Clear observation and understanding of these steps is an essential precondition for risk assessment and taking necessary measures that will create a better living and working environment.

MANAGING PROJECTS IN THE FIELD OF ENVIRONMENT

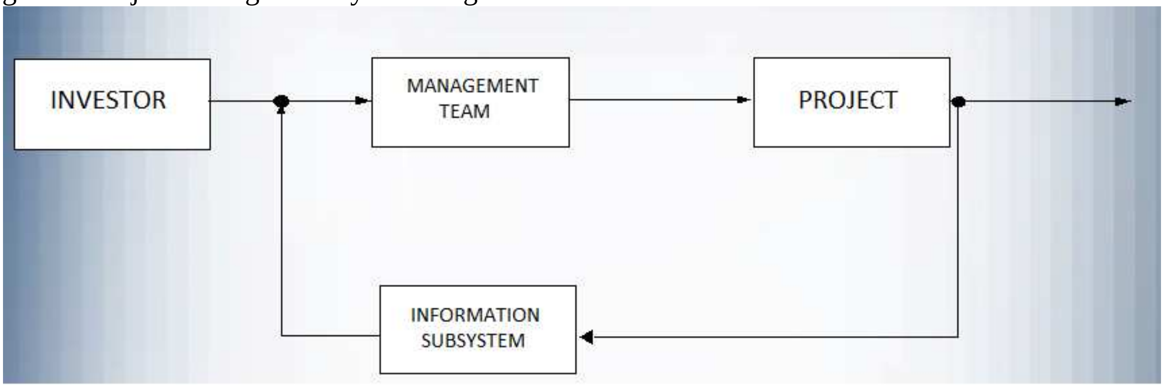
Projects have been managed since the ancient times, especially on large and complex projects that are several thousand years old, such as Egyptian pyramids or Roman infrastructural objects (roads, aqueducts…). Participants and a certain number of people who performed the management function in such historical projects had completely different terms and obligations in relation to today's model of project management. Often, they were not fully aware that they are participants of the process we call project management today. Naturally, we must take into account social organization of that time, the inhumane principles of division of work and the needlessness for some of the knowledge that is today primary in making the project successfully realized, i.e. completed to the satisfaction of all the participants in it. The biggest difference in the realization of today's and past projects and the process of their management perhaps lies in today's complete domination of mechanized work. Heavy human work is, wherever possible, replaced by the work of sophisticated machines in all domains. Today, project management also involves machine management and various models of optimum selection of mechanized work that inevitably creates more humane conditions for life and work. The first question that arises, when it comes to project management, is the definition of the project. Organizations, businesses, companies perform various types of works.
Their work generally includes two basic concepts: operations (procedures) and projects (intentions, plans). Of course, both concepts often cross with each other and share many common characteristics, the most important of which are: they are performed by people, they are constrained or forced to resource constraints, and finally, both concepts are planned, executed and controlled. Their diversity relates to the fact that operations are repeated and that their execution is ongoing, while the projects are unique and temporary, or casual. Accordingly, the project can be defined as a temporary endeavor (effort) undertaken in order to create a unique product or service. Temporary means, in this case, that each project has a definite start and (if everything goes well) a definite ending. Uniqueness means that each product or service differs in a certain way from all similar products or services.

Projects are implemented at all levels of the organization and can involve the engagement of one person or several thousand people. They sometimes need, in order to be fully completed, less than a hundred working hours, and often millions of hours. The project can be executed within a single working unit in an organization, but it can intercept during the implementation of several working units or organizations, for example in joint venture organizations. The temporary nature of the project indicates the inevitability of the existence of their definite beginning and definite end. The end is reached when all the objectives of the project have been achieved or when it becomes perfectly clear that the objectives of the project cannot be achieved and the project is then interrupted. Temporariness does not mean that the project lasts a short time. The execution of many projects lasts for several years, but they are also temporary in nature. In any case, the duration of the project is definitive, and the projects are not an ongoing effort. Temporariness and/or periodicalness do not in any way reflect themselves on the product or services that result from the project. Many projects are being undertaken in order to produce lasting results. For example, raising a national monument, as a result of the project, is expected to last for centuries. One of the consequences of project time constraints is that project teams rarely outlive them. Namely, immediately after the completion of the project or project phase, project teams are disbanded, and team members deploy to other projects. The uniqueness of products or services means that projects involve the performance of something that has not been done before and is therefore unique. A project or service can be unique even in the case when it belongs to a category which is very large. For example, thousands and thousands of business-residential building have been built, but each one is individually unique – it has a different owner, a different user, a different project based on which it was built, a different location, a different contractor, and many more different characteristics.

Finally, a logical question is what a project management truly represents. It is the application of knowledge, skills, tools and techniques in order to achieve, or even overcome, the needs and expectations of the key project participants in the project. Achieving and/or overcoming needs and expectations involve a constant evaluation (in terms of competition) between the following requirements: the scope of work, time, price and quality, key project participants with all of their different needs and expectations (and, as a rule, completely different views of the project), identified requests (needs) and unidentified requests (expectations). Many of the techniques and knowledge needed to manage projects are inherent and characteristic only for project management (for example,

critical path analysis or work breakdown structure – WBS). The World Bank Guide defines the project management as: "Mobilization of various sources and coordination of their activities with the goal of accumulating the work performed by each individual into a multidisciplinary team effort to achieve the investor's goal within an agreed plan, budget and quality."
The project management team, in addition to engineering management, procurement of materials, construction and handover of the facility, is required to engage in the execution of other important jobs on the project, such as ensuring project financing, obtaining consent, approval, etc.
A project represents a comprehensive cybernetic (manageable) system – a separate subsystem performs a management function (Figure 2).

Figure 2. Project management system diagram



Source: [3]

In modern times, the essence of success of the project management is maintaining the balance in a "vicious" triangle – cost, quality, and execution time. In order to maintain this balance successfully, it is necessary, after the initiation of the project, to begin its life cycle with the design process in accordance with a precisely defined procedure valid for all objects of the same type.
Project management includes:

- Planning
- Organizing
- Control
- Coordination

The planning process, in order to achieve balance, is a very important phase in the project's life cycle. The planning process itself is very complex and consists of several sub-phases, and the project manager is, during this process, closely approaching to the key parameters of the project in order to approach the truth and certainty of the project. During the planning phase, the project manager deals with the exchange of information about the project and negotiation that is being conducted through the next stages in the life cycle of the project. Planning can be defined as: determining all activities, their duration and necessary resources, and determining the dynamics of their realization in accordance with the projected deadlines for completing the project in whole or in some of its phases. The planning process sub-phases are: resource planning, cost planning, technological division of the project, time planning and optimization of plans. The basic principles of planning are: to strive toward the parallelization of works, the inclusion of resources (manpower, machinery and materials) should be gradual, the use of all major resources should be continuous, the plan must be realistic and should be the basis for control. The organization includes: forming an adequate organizational structure of the project, coordinating activities of participants, undertaking other organizational measures.
Control, among other things, is: identifying deviations from the planned or projected size, and taking appropriate corrective measures to eliminate these deviations. Coordination includes the following activities: project planning, controlling and monitoring the realization of the project, technical and technological issues of the project, economic and legal issues of the project, relations with the investor, relations with the companies involved in the project realization, project team management. Features which are common to all projects:

1. Objective – Each project has a goal to accomplish.
2. Deadlines – All projects have a defined goal that must be executed within a specified period.
3. Complexity – Is related to the technology that achieves the objectives of the project.

4. Scope and nature of the task – If an appropriate plan of realization is made, each project can achieve the goal within the required time frame.
5. Resources – Each project uses some resources (people, equipment, material, financial resources).
6. Organizational structure – the organizational structure and the project manager who will have the appropriate authority and who will be responsible for the project must be determined. Information and control system based on the functional lines of authority.

QUALITY OF LIFE

As we have already said, the concept of quality of life is new in social sciences. It should be immediately said that there is no unique and comprehensive definition of quality of life. Nevertheless, we can define it as follows [5]: the concept quality of life usually describes the factors that have an impact on the living conditions of a society or an individual – in general, the quality of life refers to the level of well-being of an individual or a group of people. It is possible to make a large number of combinations of groups of values in a relation to the concept of quality of life. Urban sociologist Ljubinko Pusic lists several: welfare, physical security, flexibility, ownership, identity, experience, fulfillment, opportunities, hopes, expectations, basic needs, the realization of family life, improvement, pleasantness, trust, justice, happiness, status, free time. “Quality of life is defined as an individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations and standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, and their relationship to salient features of their environment.” [9]

History of the science of quality begins with the first written traces of responsibility for product quality (Code of Hammurabi, records on the Egyptian Pharaohs’ tombs, etc.) The demand for quality comes as a consequence of the development of the society, the division of work and the development of skills and knowledge in the production of products/ services. The development of the capitalist economy, especially in the XIX and XX centuries, marks the importance of the organization in the realization of products/ service. Therefore, the content of the concept of quality changed over time. At first, the concept of quality referred to the product, but later, in the second half of the 20th century, it expanded to the processes and organization as a whole. In this way, the aspect of creating and consuming products is rounded up in a certain way. The product, organization with resources and the environment were at the center of consideration. At the same time, the concept of sustainable development and the global quality aspect developed. Unfortunately, a man as an individual, with his fears, hopes, needs and expectations, remains unexplored. The third concept is directed towards him, which is permeated with the previous two. The quality of human life depends not only on the economic situation, but also on many other factors, including physical and mental health, social security, social institutions (health, educational, judicial), political stability and the environment. In some highly developed countries, security on the streets is in decline (terrorism, theft, etc.), which is considered significant, by the residents of those regions, for reducing the quality of life.

In other regions, a high level of economic development of society is often in contradiction with the individual’s freedom, his liberal and professional and other limitations. Obviously, we need to reassess social and individual values, or, as Nietzsche said, to re-evaluate all values. The problem is that this is very complex, because it observes a human being and society and its institutions. In this attempt to study values, involvement of sociologists, psychologists, professional organizations, state institutions, parents and teachers is inevitable. Looking from this perspective, the perspective of top management and stakeholders also changes. There is a growing demand for the organization’s social responsibility and their leadership is not restricted to the territory of the organization, but it rather takes on social content. There are numerous social indicators that have been developed to compare the quality of life in different environments (cities, regions, countries, continents). The first report was published in 1992 by the United Nations Development Program, according to which Canada was the country with the highest quality of life. The criteria refer to the fulfillment of life expectations, education level and the purchasing power. This does not mean that all aspects of quality of life are at a satisfactory level, but by comparing them to the other countries, there may be areas that are unsatisfactory. Measuring quality of life is, therefore, only a way to improve the underdeveloped factors of quality of life.

Another aspect of quality of life is significant. It is a link between the quality of life and quality and characteristics of the economy of the country or region. This connection is mutual. On the other hand, the level of quality of social institutions and the connection between people by gender, religious belief, race, language, tradition, etc. must be considered. Therefore, the quality of life can be described as a process, in which annual reports are merely a starting point for the future improvements. In terms of quality of life, three more concepts which are partially included must be mentioned.
Those are:

- Quality of time, i.e. how much an individual effectively uses the time for his/ her activities and enjoys them, meets his needs, etc.,
- Quality of working life, which includes security and safety at work, respect, equal opportunities for development and promotion, freedom of critical thinking and creativity, child care and care of the elderly, etc.,
- Qualitivity, as a quality and productivity symbiosis, which enables simultaneous increase in the quality and performance of the organization.

Quality of life (QL) has been the subject of sociological research since the 1970s. The first research was more about the possibility of achieving individual goals and choosing an ideal lifestyle. Later, this approach was complemented by available financial and material resources and environment. Accordingly, three main characteristics of quality of life are:

- Quality of life refers to individual life situations, i.e. it is observed from a micro perspective. Economic and social reality are important but are not at the heart of consideration.
- Quality of life is a multi-dimensional concept that includes everything that is mentioned in the introduction.
- Quality of life is measured by objective and subjective indicators. Subjective indicators are important for identifying goals and orientations, which can later be linked to objective living conditions [1].

The quality of human life depends not only on the economic situation, but also on many other factors, including physical and mental health, social security, social institutions (health, educational, judicial), political stability and the environment. In some highly developed countries, security on the streets is in decline (terrorism, theft, etc.), which is considered significant, by the residents of those regions, for reducing the quality of life. In other regions, a high level of economic development of society is often in contradiction with the individual’s freedom, his liberal and professional and other limitations. Obviously, we need to reassess social and individual values, or, as Nietzsche said, to re-evaluate all values. The problem is that this is very complex, because it observes human being and society and its institutions. In this attempt to study values, involvement of sociologists, psychologists, professional organizations, state institutions, parents and teachers is inevitable. Happiness is the basis of satisfaction with one’s own life. It can be subjective and objective. This is precisely the case, because people constantly compare subjective view with objective reality.
The subjective state can be:

- Positive (happiness, fulfillment, joy, satisfaction, self-confidence),
- Negative (misery, depression, frustration and worry).

As the human condition or subjective happiness of an individual and a group of people or even a whole nation is changeable, a logical question arises, when and how to measure subjective happiness? The statements, which are the result of the current mood, obtained in one condition or another can be quite different, and the results obtained from it are unreliable. In this case, the size of the sample does not change the matter significantly, because the dynamics of changes are extremely fast. With the dynamic changes of the mood, it can be said that the state of an individual can be really bad or really good. On the other hand, people can be happy in different ways. At the same time, individual differences create an individual diversity in the intensity of action, but not in happiness.

THE RELATIONSHIP BETWEEN THE QUALITY OF LIFE AND THE ENVIRONMENT

When talking about the quality of life and the quality of the environment, it is worthwhile to look back at the ecological culture and awareness, and the sustainable development as well. Ecological culture is a part of the general culture, a special human quality of relationship with the nature and the environment, the quality of relationship with another human as a value. The crisis of the environment is nothing but the crisis of valuation. An altered relationship towards the nature requires cultivating needs, building values and beliefs that can be reduced to the motto: to give more than to take. One should not forget that only socio-cultural solutions can affect the causes of environmental degradation, while the scope of technological solutions is mainly limited to removing existing pollution. Ecological culture is a part of everyday life. Ecological culture is a part of the culture of living, the area of life that needs to be cultivated. The culture of everyday life, among which ecological culture, in particular, indicates that not only works of art are relevant but almost all manifestations of human living, beliefs, acts and actions, the products through which people ensure survival, integrity, reproduction… According to Jean Baudrillard, the nature is portrayed as a wild force that needs to be tamed, chained, and made to serve a man and his victorious walk into collapsing everything that exists on the planet Earth. By destroying the forests and submerging ancient settlements, the man became a giant. And the giant cannot be expected to serve the nature, to listen to its inner rhythm, to harmonize aspirations and desires with it, as it cannot be expected that an ideology, turned against the human nature, the nature of the economy, have regards toward the forests, rivers and lakes.

The ecological awareness and spiritual dimension of the ecological culture encompasses the acquired knowledge and habits, adopted values, attitudes and beliefs of accepting norms on what is healthy and quality in the natural and social environment and what is not, how to maintain your health and what is endangering it, in what way can awareness and quality of people’s lives be improved in the existing conditions. Ecological awareness is accompanied by ecological actions, operations and acts that individuals and groups actually undertake in preserving, improving and creating a healthy natural and social environment. In the world of ecological operation, a well-known slogan is: think globally, act locally. This principle can be the key point of every ecological culture as an important element in the whole way of living. Only the perception of culture as a way of life enables a speech about an ecological culture that implies certain beliefs, values and readiness to participate in the care of your environment. It includes knowledge, attitudes, habits, skills, convictions, responsibility, norms and patterns of behavior. It cultivates and fosters readiness for an individual to behave according to the need for a healthy environment. It includes: housing culture, culture of cultivating green areas, health culture and hygiene, culture of work and rest, traffic culture, media culture and culture of visual communications, culture of cultivating flowers and breeding animals, culture of human relations, culture of excursion, culture of spatial planning of the environment, urban culture, culture of responsibility, horticulture. In everyday life, individuals behave in different ways.

The ecological culture expresses the relationship between the man and the environment. The prerequisite for this is the possession of ecological awareness, but developed ecological awareness does not always have to produce adequate patterns of action and behavior. The quality of relationship between the human and the environment is perhaps best speaks about the following message: because of the objects that satisfy its current rapacity, it destroys large plants that protect the soil, which quickly leads to infertility of the soil, causes the drying of the springs, ridding it of the animals which found their food there, that leads to the fact that large parts of the globe were once very fruitful and in every way highly populated, but now they are bare, infertile, uninhabitable, empty. It seems like it is destined to make the globe uninhabitable, to eradicate itself. The complex combination of what the nature itself created and what the result of human activity created made the living environment as we know it today. Therefore, by analyzing the quality of the environment, we can talk about the quality of natural and social elements that characterize today’s environment. Natural elements are there to satisfy the existential needs of humans while social elements help in meeting social and personal needs. Natural elements make everything that surrounds us, from water, air, and soil. It is clear that each of these factors significantly affect the quality of life. In what way can we influence the process of creating a better environment that will generate suitable quality of life, both for the 21st and the centuries to come? In this direction, we should have clear awareness of the following steps:

- Maintenance and, if possible, improvement of the state of resources;
- Preventing and solving the environmental problems;
- Determination of the limits of the environment (carrying and assimilation capacity);
- Hazards warning as well as promotion of new effective technologies and policies;
- Improving the quality of life, whenever and wherever possible.

Thus, at least two important processes for environmental protection are characteristic of the EU: decentralization of political activities related to environmental protection and involvement of citizens in environmental decision-making. Most countries have also made certain strategies that address the issues of sustainable development and guidelines that should point to the direction of action when adopting new normative and legislative acts. Based on everything stated, it can be noted that in the process of creating a new value that allows normal life and reproduction, it is possible to speak about three types of capital: natural, economic and social. [7]

A certain group of US researchers have found that the value of the environment is twice as large of everything that is produced on the planet. Each of them is special and has its own characteristic that makes it specific, different, on the basis of which these three types of capital cannot be changed. For some elements of the natural capital, it is possible to find some type of substitute that changes the natural capital more or less. However, some things cannot be replaced. Moreover, the destroyed ozone layer creates problems for the entire population currently living on Earth, as well as for the future generations that have not yet been born. Economic capital is, however, a special category and it is always in the focus, regardless of the many challenges that society is exposed to, both from the perspective of endangering the environment and from the perspective of social security for present and future generations. In order to be sustainable, the system must have a balance. [6]

To all this should be added the organizational culture, which by its definition and basic function creates preconditions for a clear review of the causes of a particular state. Why do we behave the way we behave? To a large extent we often deal with consequences rather than causes, and therefore we are not on the way of solving any problems that today's society faces. One of the most accepted definitions in our region is the definition that defines the organizational culture as a system of assumptions, values, beliefs and norms of behavior that members of an organization developed and adopted through a shared experience that manifests itself through symbols and directs their thinking and behavior. [4] Linking the role and the importance of organizational culture to project management in the environment is not entirely unknown. The absence of coordination in the process of creating an appropriate culture indirectly influences the creation of an environment that, in the long term, becomes increasingly burdened with human activities, and the question arises as to where the limits are and when we will face the response of the nature to everything that is inadequate ecological and organizational culture in today's time. [10]

EU environmental policy is based on the principles of preventive action (before the damage or pollution occurs), the "polluter pays" principle (whenever possible, environmental costs should be borne by a legal or natural person who endangers the environment, and not by society as a whole), the fight against environmental degradation at the source of pollution (where it is easier and more economical to eliminate the consequences of pollution), the shared responsibility of the EU and all participating countries to be EU members and the integration of environmental protection into other EU policies (such as agriculture, transport, energy). The goal of each country should be reflected in the desire to establish a sustainable environmental protection system, as well as the significant involvement of this policy in other sectors. In this way, preconditions for better health, better quality of life of citizens and a competitive economy are provided.

CONCLUSION

Project management appears to be a very important activity that should help us to clearly understand the risks that the present time carries with it when it comes to the environment and the quality of life. We cannot expect a certain future without a clear review of risky activities and their characteristics, and defining the scope and consequences for the immediate and wider environment. In light of sustainable development, it can be said that the goal of project management in the environment is to optimize the use of natural potentials without disturbing the environment and to maximize the welfare of man, his safety and adaptability. In order to come to this stage, we need powerful institutions and the ability to recognize, prevent and mitigate socio-economic and physical hazards and manage them for the sake of the well-being of the generations to come.

Given the fact that there are many different interested parties today, different educational profiles involved directly or indirectly in addressing environmental issues, planning of the management process can, due to insufficient understanding of natural process and misinterpretation of facts, become one-sided and non-objective. Because of this, we believe that we have proven the initial hypothesis that without the management of environmental projects we cannot talk about the good quality of life.

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PERFORMANCE OF THE SPSS SOFTWARE AND ITS APPLICATION IN MANAGEMENT AND SAFETY PROJECTS

Abstract
SPSS is the abbreviation for the Statistical Package for the Social Sciences. Despite its name, given by its developers Norman Nie, Dale H. Bent, and C. Hadlai Hull in 1968, the application of the software is so universal today that it is used in almost all areas where statistics is needed: sociology, psychology, medicine, economics, political science, natural sciences, education, occupational and environmental management, local and other government institutions, and many other areas. SPSS is a computer software used for the creation and implementation of research, data mining, content analysis, statistical analysis, and joint work and implementation of research. Bearing in mind the wide spectrum of the application of SPSS, we can safely say that it occupies a significant place in the implementation and management of safety projects in all areas.

Key words: SPSS software, statistics, data processing, natural and occupational environment, management and safety.

INTRODUCTION

So far, statistics has developed to the extent that its name itself no longer corresponds to the contemporary content. Statistical methods carry out assessments, measure risks, explore tendencies, analyze relationships and factors that determine them. It still deals with quantitative descriptions, but the states are understood in terms of moment or point on a dynamic development line. Today's statistics means triple content. In addition to statistics in narrower sense or descriptive statistics, it includes statistical analysis and statistical theory. Statistics in the narrow sense or descriptive statistics is aimed at collecting, processing and presenting data. Statistical analysis implies a set of stochastic methods of quantitative analysis, phenomena and their relationships, which enable the acquisition of numerical information, their qualitative interpretation, conclusions and formulation of the legality of the behavior of the observed phenomena. Statistical analysis identifies statistical methods, explains, proves and improves them.

The subject of statistical research is mass phenomena, which by their nature are variable, so they should be observed in a large number of cases and conclusions should be made based on these observations. Because of this, statistics is most often interpreted as the scientific method of quantitative research of mass phenomena. Tasks of statistics are: to reveal the essential characteristics of the observed phenomenon; to reveal connection with other phenomena; to discover the causes and consequences of their condition and changes; to discover legitimacy in phenomena and to explain their evolution. The importance of statistics is growing with the development of the country. Each community requires the development of more extensive and complex statistical surveys, which should be mutually comparable.

Bearing in mind this fact, the application of statistics in project management both in the field of occupational safety and health, as well as in the field of environmental protection, plays a significant role in the collection and storage of a large number of data. These data play an important role in the realization and evaluation of the results obtained during the implementation of a project in the mentioned areas. Statistics also provides a certain degree of prediction in managed projects, which significantly facilitates the role of persons engaged in the implementation of the project. This raises the question of which software package would be most suitable for managing statistical data in the project management process in the field of occupational and environment protection.

USING THE SOFTWARE IN THE PROJECT MANAGEMENT AND SAFETY

During the last 20 years, the paradox of productivity has motivated the researchers to be interested in measuring the impacts of software on the project management and safety. However, there are few studies on the impacts of software on the performance of engineering projects. Nevertheless, project management makes use of business processes (supply chain management, human resources management, inventory control, planning, etc.), which are handled by means of IT/IS (i.e. project management software packages).

According to the standard ISO/IEC 2382-1:1993, a software package is a “complete and documented package of programs provided to several users, with the aim of the same application or function”. Project management software packages generally facilitate the integration of project data, the interaction with enterprise systems and the interoperability with new IT. Besides optimizing the productivity of the teams, the system allows making better decisions, maintaining a competitive advantage and implementinng an effective project management. This type of software consists of subsystems developed to treat various aspects of project management: procurement, construction, cost control, planning, etc. [1]
Several interactions between the software subsystems enable the flow of information. Each subsystem thus becomes an information source for other subsystems. Figure 1 illustrates the typical interactions between the subsystems of a project management software. The arrows indicate the direction of the information flows between the subsystems. For example, the subsystem Document management receives information from the Procurement management and Engineering process management subsystems. [2]

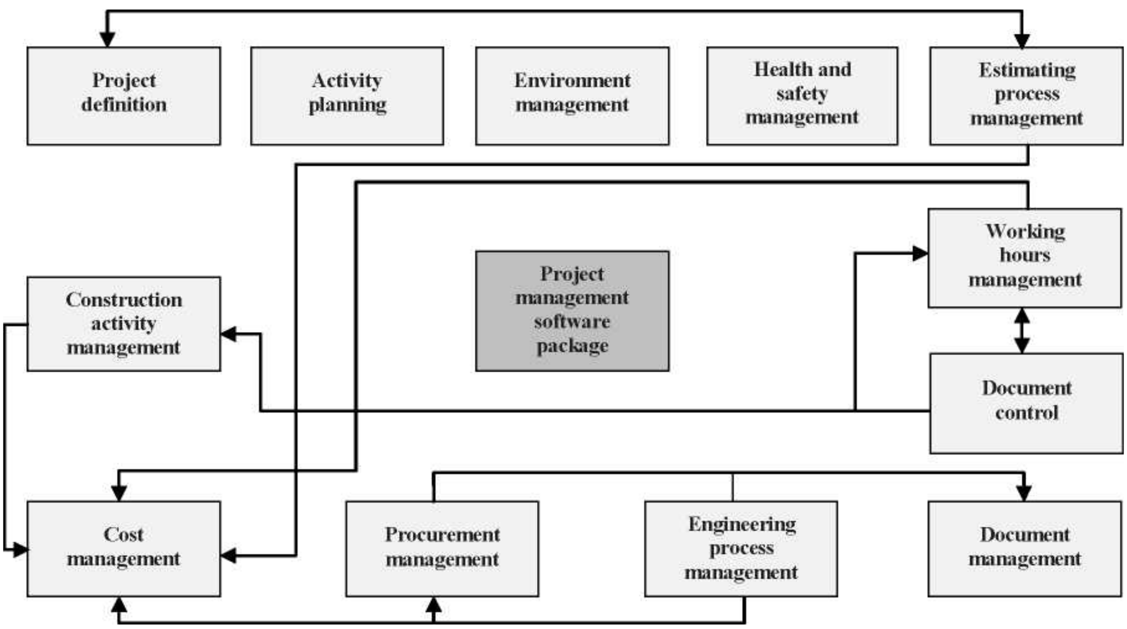

Figure 1. Interactions between subsystems [3]

Having in mind the presented figure 1., we see that the software package in project management takess a central place, which points to the software package itself. The paper starts from the SPS program as a potential software solution in project management in the area of occupational and environment safety. The SPSS program represents a widely accepted software solution in many scientific projects aimed at certain anticipated events and expectations in a given field of study. Therefore, in the further work we will present the way of work and performance of the SPSS program itself.

SPSS AND SCIENTIFIC RESEARCH

SPSS is an abbreviation for the Statistical Package for the Social Sciences. Although the authors Norman Nie and C. Hadlai Hull named their program in 1968, the application of the program is so universal today that it is used in almost all areas where statistics is needed: sociology, psychology, medicine, economics, political science, natural sciences, education , government institutions and others. According to Wikipedia's online encyclopedia, SPSS is a Computer Program that is used to create and implement research, data mining, content analysis, statistical analysis, and collaborative work and implementation of research.

The basic elements of the interface and the beginning of work with the program are: after opening the SPSS program, we will welcome the initial screen that we can see in Figure 1. This is the so-called Data Editor (Data View), which is used for data entry and manipulation. In the lower left corner we can see the Data View tab, and next to it Variable View. This is another important part of the interface, which will serve us to define variables. Practically, the work in SPSS consists of four phases: defining variables; data entry; analysis; interpretation of results. Figure 2. View Data View Window in SPSS is like most programs in Windows, SPSS has a line of titles, a drop-down menu, a toolbar, a status bar, and a central workpiece. SPSS has only one toolbar, but it is interchangeable and can be adapted to the specific needs of users. The working part is a table like the one in Excel, but which has variables for the columns, and for the rows of respondents. In this table we enter data obtained by research. The first three and the last two drop-down menus are more or less identical to all Windows programs.

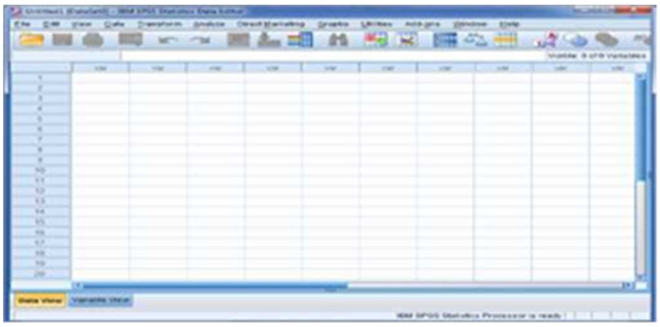

Figure 2. The look of the Data View window in SPSS

PREPARED WORKS

Data processing with a computer has its own specificity, so it is necessary to prepare for that process before entering the data itself. It is important to keep in mind that the computer can only manipulate the numbers, and it is necessary to convert the research into some sort of numerical form. Before the data entry itself, it is necessary to define variables. SPSS will know that it also counts without defining the variables, but the print will be confusing and incomprehensible. In order to use SPSS Output in the research, it is useful to define all the variables in detail. We'll do this in Variable View.

DATA ENTRY

Data can be entered in SPSS in several ways. In addition to the direct mode, it is possible to use Excel and Notepad. We will explain in more detail the first two ways. It is advisable to save the file immediately after defining the variables and to give it a name (Save As), and as soon as you enter the data, you will record the data more often. Direct data input is very easy. Data is entered into the Data View list, by inputting all the variables of one case, questionnaire, and so on, and then we move on to the next one. We move from one field to another by using the arrows or using the TAB button, and then we go to the next line (questionnaire, case, questionnaire). It is advisable when data is being entered to save the data as often as possible to the hard disk drive with the SAVE option from the File drop-down menu or the CTRL + S shortcut, because in the event of a power failure or other computer problems, we can remain without the data that we have painstakingly entered. Direct data entry is shown in Figure 3.

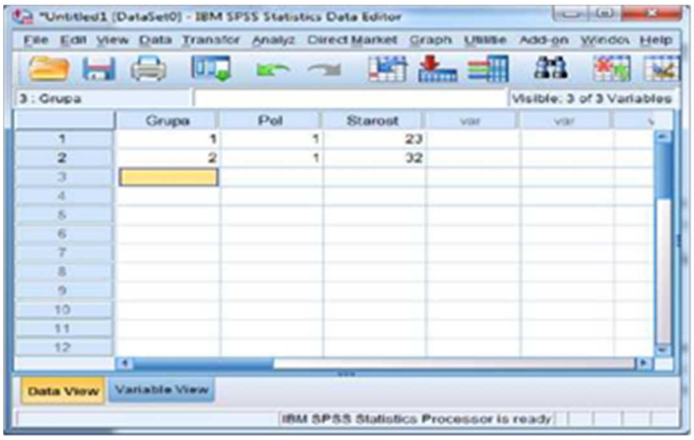

Figure 3. Direct data entry in Data View SPSS

TRANSFORMATION OF DATA

The data entered in the tables are not always immediately ready for analysis. Sometimes some variables are not adequately numerically encoded, or need to be recalculated, and the like. After all the data has been entered, and before statistical calculations and analyzes, data transformation is required. Let's say that we have the variable Year of Birth in our table, but we actually need to know how old people are. Transform / Compute Variable will open the Dialog Box (Figure 4) in which we will set the new variable Age variable in which the variable Year of Birth will be calculated so that the values of the year of birth are deducted from 2015, (current year).

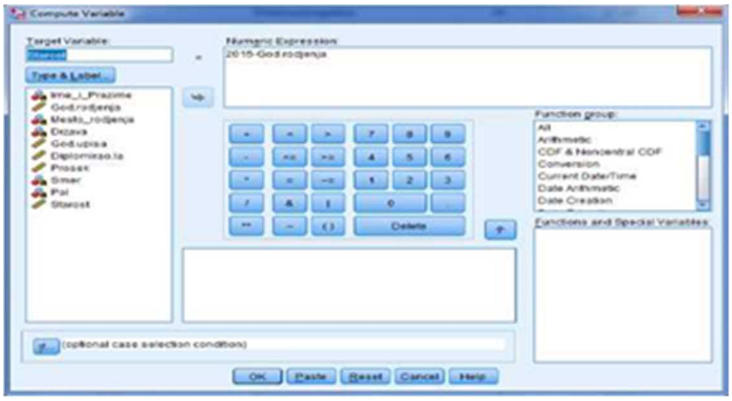

Figure 4. Dialog box in which we enter the name of the new variable and formula.

DESCRIPTIVE STATISTICS

Descriptive statistical analysis is a set of methods for calculating, displaying and describing the basic characteristics of statistical series. Descriptive statistical analysis has the following tasks: grouping and compiling statistical data; displaying statistical data; determination of basic indicators of statistical series. In numerical variables, it is possible to calculate many descriptive statistical measures that can be used in our research. Analyze / Descriptive Statistics / Descriptive opens windows where we select variables and statistical measures. We select several variables and then click the Options button to select which descriptive dimensions we want (Figure 5).

Figure 5. Selection of Descriptive Statistical Measures [4]

DIFFERENCES TESTS

When statistical observation is organized with the aim of analyzing the pattern, it is inevitable that it is needed to compare the description with either an imaginary theoretical size, or with some other pattern in the same way. Differences or identities may be random or organized. Random differences are the consequence of accidental variation and in the direction, or sense, and can not be predicted. Organized changes lead to the effects of factors that can, or are desirable to be identified. In comparing the tests of the sample belonging to the sample, the difference between them, the researcher sets a zero and a working hypothesis: H 0, usually for the zero hypothesis, we assume that there is no statistically significant difference between the sample and the population (or between the two samples); H 1 working or alternative hypothesis: In testing, we usually assume that there is a statistically significant difference between sample and population (or between two samples). Also, the level of significance with which we are going to do the test, that is, the level of security with which we can claim that something is the same as we claim. As a standard level of reliability, it usually takes the level $p = 0.05$, which means that with a 95% confidence we can claim that something is the same as we claim. As a higher degree of reliability, $p = 0.01$ is taken, that is, 99% are sure of what we claim. [4] [5] [6]

TESTING OF STATISTICAL LINKS

Among the phenomena, or variables that describe them, there may be different types of connections, or correlations. One of the fields of statistics is to discover, measure, and describe these connections. Unlike experimental projects, these variables are not modified and controlled, but are described in their natural state. Correlation techniques can: explore the connection between pairs of variables (correlation); predict the values of one variable based on the second (bivariant regression); predict the values of the dependent variable on the basis of several independent variables (multiple regression); identify the structure of the group of related variables (factor analysis). Correlation describes the magnitude and direction of the linear relationship between the two variables. With SPSS we can calculate several statistical parameters for measuring the correlation, which we choose depending on the level of measurement of the variables and the nature of the data. For variables from the interval scale, we will use Pearson's r-coefficient of correlation, while Spearman's ρ-coefficient will be used for variables with an ordinal scale. The correlation coefficient is a value between 0 and 1. According to various authors, these keyboards are interpreted differently, but for the purposes of this paper, we will accept the interpretation according to Cohen, where: small correlation mean correlation large correlation There are several types of tests to determine correlations between variables, and mostly relate to the type of scale to which the series belongs. [4] [5] [6]

CONCLUSION

Without elementary concepts of statistical theory, the average user will find it difficult to get in an advanced statistical program like SPSS. However, it is sufficient to know the basics in order to embark on the world of numbers and their connections and differences through the statistical techniques that this program has. SPSS is a powerful tool in the hands of the person who uses it, which can not be missed by any chance. However, not all of us need to be absolute experts in all fields. It is sufficient to know elementary things in order to enable ourselves at least a preliminary statistical analysis of the research.

The idea of work is to bring the possibilities of this program closer to those who may need it, especially individuals engaged in national and international projects in the field of security. SPSS is a very complex program and this work does not exhaust a small part of its capabilities, but puts emphasis on its importance and application in project management, especially in the field of work and environment protection.

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PROJECT-BASED ORGANIZATIONS AND KNOWLEDGE TRANSFER

Abstract

Over the past decade, project-based organizations have attracted the attention of the scientific and professional audience. Special attention has been given to the ability to organize project knowledge and its application not only in business but also in the implementation of new projects and the development of innovations. The subject matter is the organizational knowledge which is considered as a strategic resource of business organizations. The authors point to the ability to systematically create, collect and transfer knowledge that could significantly contribute to achieving long-term goals and competitive advantage of an organization. However, despite the fact that benefits from knowledge transfer are widely recognized, practical application of knowledge in projects still faces challenges and obstacles. In this paper, project work (retrospective approach) has been observed in relation to the problems of storing, transferring and applying project knowledge in the organization.

Key words: project-based organizations, knowledge transfer, safety.

INTRODUCTION

The literature studies show that that hazards and risks in the working and living environment are continuously growing despite the simultaneous development of research about these issues. Also, the prevailing focus is on how to implement the results of different projects in policies and programmess pertaining to risk and hazard reduction and improving the performance of safety and protection in the working and living environment. Risk researches explicitly point out that a higher level of knowledge is not sufficient enough to reduce the trend of growth in risk statistics, and increase the applicability of knowledge about risk management. In complementary analysis of the contradictory development, referred to as "knowing sufficient and applying more", Weichselgartner and Obersteiner [1] argue that, despite the great expansion of the knowledge-based risk systems within special projects and research programmes, there is inadequate progress in the transfer of knowledge and its application in practice. This has raised many questions about potential barriers to project management in terms of capturing, transferring and applying knowledge in modern organizations.

White et al. [2] examined the possibilities for more effective use of knowledge and pointed out that there is a need for better assessment of the results of the application of available knowledge in the organization, the community and at other levels. Similar findings can be found in other authors [3] [4] [5]. Researchers often do not consider the needs of potential users when they start their projects and conduct research, while on the other hand, decision-makers do not always use the information and project knowledge to make appropriate decisions. Also, there is insufficient utilization and sharing of knowledge within the organizations themselves (organizational level) with the aim to enrich the fund of organizational knowledge and development of organizational culture.

Despite the importance of the critical link between project management and knowledge management, these issues have not yet been fully answered. This paper deals with some of the challenges associated with project work and knowledge transfer within an organization. The motivation is twofold: we believe that the role of knowledge requires greater attention in managing projects and practices of safety and protection as well. Hence, this paper presents a kind of a call to authors to integrate the issues of transfer and knowledge sharing during the project implementation. We are confident that solving these issues could foster significant improvements in the policies and practices of safety and protection in working and living environment.

PROJECT-BASED ORGANIZATIONS

Project-based organizations seek to coordinate and integrate project knowledge in products and innovations [6], and to permanently develop capacities and innovation strategies in order to respond to contemporary market challenges and customer needs [7]. In the past decade, special attention has been devoted to examining the capability of project-based organizations for collecting knowledge and its re-use during project activities [8] [9]. The ability to systematically create, organize and gather knowledge can significantly contribute to the achievement of long-term goals [10], while the organizations which are particularly successful in transfer and re-use of knowledge will more easily maintain a competitive advantage [11]. Although the benefits of knowledge transfer seem to be recognizable [9], effective usage of knowledge through projects is still faced with challenges and difficulties in practice [12].

KNOWLEDGE TRANSFER

In a modern business context, knowledge is considered to be the crucial resource of an organization for achieving effectiveness and competitive advantage [13]. In managing projects, the transfer of organizational knowledge through the project provides a chance for research, accumulation of lessons learnt, avoiding errors [14] and improving the overall performance. Argote and Ingram [11] define knowledge transfer as a process through which the performance of one unit (group, department, etc.) influences the other. In this context they use the term *"knowledge tank"* to indicate that stored knowledge opens up possibilities for future use. This knowledge preserved in this way can be used in the technological process and realization of individual tasks. Also, knowledge transfer can be carried out by moving such reservoirs and networks, such as is the case when the employees/individuals change positions within the organization or when the technology and routine in the organization are taken over by someone else. Alternative transfer can be done by modifying the knowledge tank and networks through internal communication and training [15].
Knowledge transfer is accompanied by certain challenges and difficulties [16] mainly due to the fact that it is a complex interaction difficult to be reproduced elsewhere [11]. Also, employee motivation can affect the performance of knowledge transfer through communication and trainings [11].

In project-based organizations, the spatial and time frames of project implementation create the context of transfer [17]. Knowledge can be transferred through the project in different ways, depending on the way it is realized: through job rotation and lectures, at the level of the organization as a whole (e.g. if the organization implements more than one project at the same time or several parts of the same project) [17]. Difficulties in knowledge transfer often result from the fact that the focus is usually placed on time, costs and quality, rather than sharing the lessons learned [9]. The completion of the project usually influences the ending of collective learning [9], so it is unlikely that project participants will upgrade their experience and document new ideas and conclusions for the benefit of other projects [18]. After project completion, project teams are most often reorganized and moved to new tasks so that the individuals, in fact, have little time to share what they learned [19].

PROJECT MANAGEMENT AND KNOWLEDGE MANAGEMENT

The distinctiveness project goals and tasks and the distinction of project products and/or services represent a unique challenge for acquiring a new type of knowledge in the organization. Project management methodology defines the standard stages of projects, processes, patterns, activities that are repeated during different projects. Recording the data on the resources, time, quality requirements, costs, etc., is a way to store and share important information (e.g. information on the project subject and issues, results, participants, products, etc.). Project knowledge allows project team members to reduce the activities and time required for project planning and implementation. Sharing lessons learned and the examples of good practice is recommended as a key to helping others in project management. However, managers are often unaware of the importance of project learning and knowledge.
Project retrospective opens up significant opportunities to learn from experience and create knowledge for the future. The terms used in companies/organizations to describe project retrospective is "*post-partum*" or "*post-mortem*" (for unsuccessful projects). Essentially, it is about reviewing and analyzing the activities during the subsequent review of projects that can be viewed

at the level of management, team and individual. Management will be able to, through the activities of the persons involved in the project, obtain a more comprehensive image of all the processes, decisions and dynamics of the project, which is a basis for the implementation of fact-based management, as well as for developing plans for future progress and time frames. A retrospective approach opens the possibility for project managers to improve project management methods and find new ways to implement project goals. Observed from the team's point of view, teams learn new alternatives for designing roles and responsibilities in order to increase efficiency. Taking actions to improve future work and performance creates a sense of control over team activities and increases job satisfaction, work environment and motivation for collaboration. The more team members discuss and analyze their actions in a constructive way and the more they share lessons from personal experience, the more they get to know each other and their way of thinking. For individual participants, learning through the project's retrospective helps to understand how to improve the tasks and results to increase their personal effectiveness. Individuals can see what actions they or others have achieved have positive effects on performance or, which can be considered as errors. Organization can use various methods for knowledge transfer and storage in project management.

Table 1. Possible knowledge transfer and preservation methods [20] [21] [22]

Explicit knowledge	Tacit knowledge
Software tools for project management	Networks (internal social networks and communities, knowledge sharing forums)
Shared project files and drives	Interactive project management trainings
Intranets, portal, shared networks	Coaching and mentoring programmes
Shared project management guide	Video-recording
Formal content of the training	Storytelling
Project management documentation templates	After actions review, project status review, meetings after the project (project retrospective)
Frequently asked questions	Output interviews
Shared status reports, programme/portfolio master plans, etc.	Emeritus or alumni programmes (through networking of former employees with the organization)

Different transfer and knowledge activities provide the necessary prerequisites for project learning, creation of a knowledge base for creating new projects and further development of project-based organizations. Many authors consider that project knowledge (storage, transfer and application) must be viewed in direct relation to knowledge management and organizational culture [18]. We know that organizational culture influences decisions on whether to share and exchange project knowledge [18], but also limits the transfer of lessons and the application of innovative approaches [23]. However, a specific and complete understanding of such an impact is still lacking. Especially interesting are the issues of knowledge management in projects and how organizations learn from projects / experiences in order to upgrade and preserve knowledge. Both mistakes and successes are valuable sources of new knowledge that can be lost if it is not preserved and can not be passed on.

METHODOLOGY

The research subject is focused on considering the features of project-based organizations in terms of storing and transferring project knowledge within the organization (organizational learning). Starting from this subject of research, the aim of the research is twofold: theoretically, we need to reconsider project-based organizations and the problem of project knowledge transfer, while empirically we need to determine the current state of knowledge transfer in the context of project management in the observed organizations in Serbia.

We considered a descriptive research method as the most appropriate to the goal and subject of this research, and we used the following procedures and techniques: content analysis procedures, survey, i.e. survey questionnaire as a research instrument and statistical procedures for processing obtained research data. Research sample was made of the representatives of higher education organizations, organization of the electric power system and public enterprises/city government of the city of Nis. The survey covered 98 respondents who are employed in the aforementioned organizations. Out of the total number of respondents, the highest percentage is employed at faculties, more precisely 48%, which make the most dominant group in this sample.

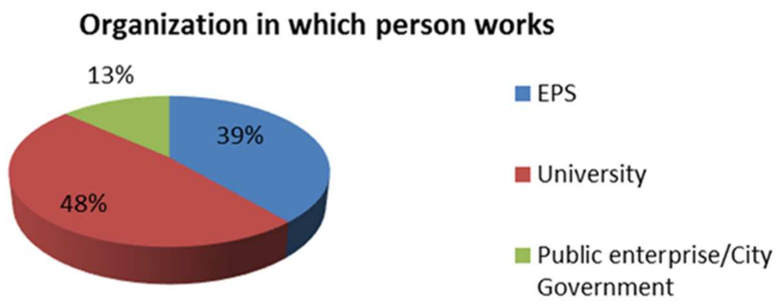


Figure 1. Distribucition of samples according to organization type

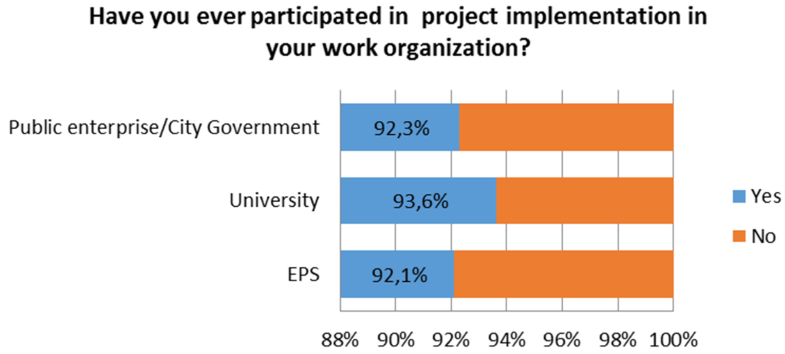
To begin with, we identified a general hypothesis that storing and transferring of project knowledge is part of project management within the organizations. A particular hypothesis was that there were differences between the organizations in terms of their employees / respondents who participate in projects and transferring project knowledge in the organization.
The hypothetical framework of the research should involve the following assumption:

1. There is a connection between the socio-demographic characteristics of the respondents and the work/participation in projects
2. There is a connection between the socio-demographic characteristics of the respondents and the observed aspects of project knowledge transfer within the organization. There is a connection between the socio-demographic characteristics of the respondents and the work/participation in projects

The obtained data of the conducted empirical research were processed in the SPSS, a program for statistical data processing in social sciences. We used the distribution of the frequency of the tested variables to display and interpret the obtained data. In order to prove the starting hypotheses, we used a chi-squared test, based on which we confirmed or rejected the starting research assumptions.

ANALYSIS AND INTERPRETATION OF RESEARCH RESULTS

The operationalization of the set research goal pointed to the need to accomplish a number of tasks that would examine project participants (different types and characters), and they involve: determining the respondents' role on projects; examining the current state of education/preparation for project work, examining attitudes/opinions of respondents on the importance of projects for acquiring new knowledge (especially knowledge in the field of safety and protection); identifying opinions on project managers in terms of sharing and transferring knowledge; establishing methods for storing and transferring explicit and tacit knowledge in an organization; assessment of one's own project experience for personal efficiency and personal development and examination of respondents' attitudes according to the needs for the development of project-based organizations in the future.
The obtained data indicate that all the organizations involved in the questionnaire realized the projects, i.e. that the high percentage of respondents participated in their realization. At the level of all three sub-samples (EPS, University and public enterprises/city governments), more than 92% of respondents participated in the realization of a project (only 7.1% of respondents from the whole sample did not participate in project implementation), (see Graph 1).



Graph 1. Distribution of respondents employed in different organizations in terms of their project involvement

The results of the survey show that the majority of respondents participated in investment and planning projects (30.6%), whereas the smallest number participated in projects in the field of crisis management (2%), (see Table 2).

Table 2. Overview of the types of projects in which the respondents participated

Which type of project did you participate in, or are currently being involved?	**Employee/respondent's organization**			Total
	EPS	*University*	*Public enterprises/ city government*	
Investment and planning	25	/	5	30 (30,6%)
Energy efficiency	2	2	1	5 (5,1%)
Safety and protection (occupational health and safety, fire protection, environmental protection)	1	22	/	23 (23,5%)
Crisis management	/	2	/	2 (2%)
Other	6	12	3	21 (21,4%)
Participation in several types of projects	4	9	4	17 (17,3%)
Total	38 (38,8%)	47 (48%)	13 (13,3%)	98 (100%)

The largest number of respondents participated in national projects (65.3%), while the smallest number of respondents took part in cross-border cooperation projects (1%), (see Table 3). The obtained results can be an indicator of insufficient participation of our organizations in international projects.

Table 3. Overview of the project character

Respondents' previous project experience and current project participation	**Employee/respondent's organization**			Total
	EPS	*University*	*Public enterprises / city government*	
International projects	/	3	1	4 (4,1%)
National projects	31	28	5	64 (65,3%)
Cross-border cooperation projects	/	1	/	1 (1%)
Bilateral projects	5	2	3	10 (10,2%)
Participation in several types of projects	2	13	4	19 (19,4%)

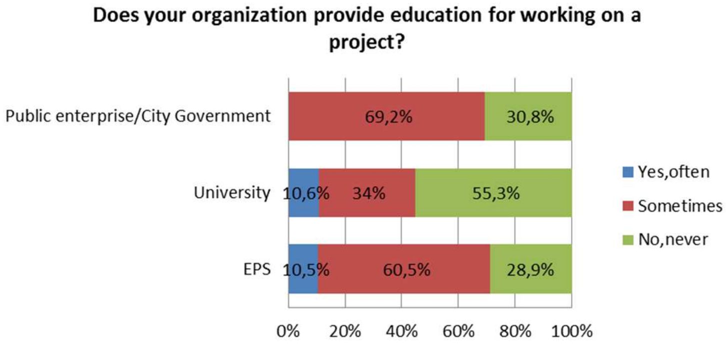
Total	38 (38,8%)	47 (48%)	13 (13,3%)	98 (100%)

Respondents who answered the questionnaire were mostly the members of the project team (61.2%), while the smallest percentage of them were engaged as project managers (2%), (see Table 4)

Table 4. Respondents' team roles in a project

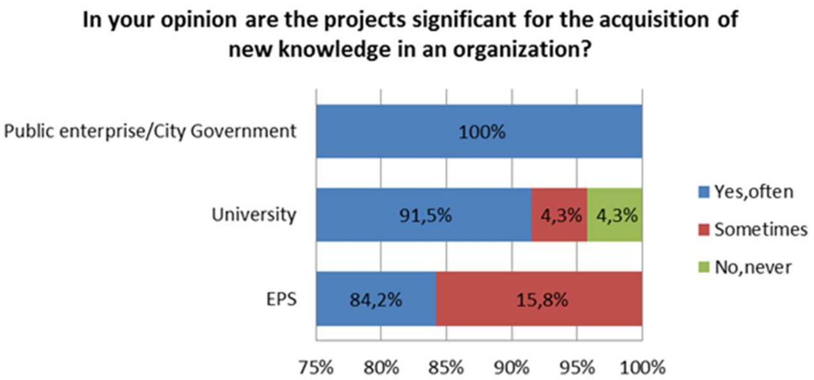
What is/was your project role?	**Employee/respondent's organization**			Total
	EPS	*University*	*Public enterprises / city government*	
In most cases, project role depends on the type and character of a project	8	4	4	16 (16,3%)
Mainly project manager	/	1	1	2 (2%)
Project team member	21	34	5	60 (61,2%)
Other positions	6	4	2	12 (12,2%)
Several project roles	3	4	1	8 (8,2%)
Total	38 (38,8%)	47 (48%)	13 (13,3%)	98 (100%)

It is of particular interest to display the results related to the preparedness/education of respondents for project work. A small number of respondents (around 10%) who are employed at the faculties within the University and EPS say that their organization often organizes project-related trainings (i.e. only 9.2% of the entire sample), (see Graph 2), whereas the highest percentage of respondents claim that trainings are organized occasionally.



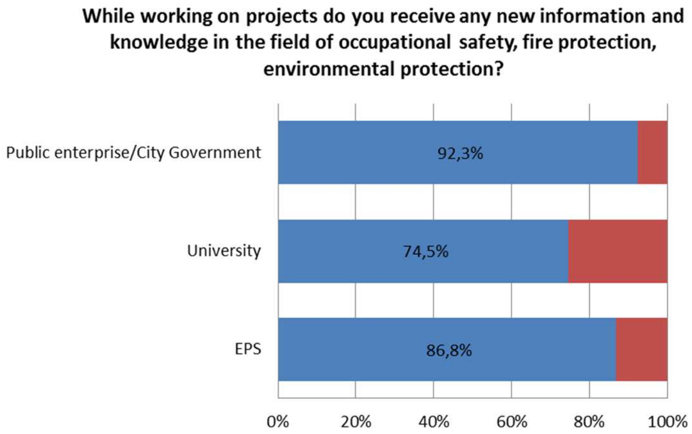
Graph 2. Education (preparation) for project work

According to the largest percentage of respondents, projects are important for acquiring new knowledge in the organization. However, it is interesting that 4.3% of respondents employed at the University believe that projects have no relevance to gaining new knowledge (i.e. only 2% of the entire sample). Having in mind the scientific and educational activity of these organizations, this data opens up new research opportunities in project management at higher education institutions (Graph 3).



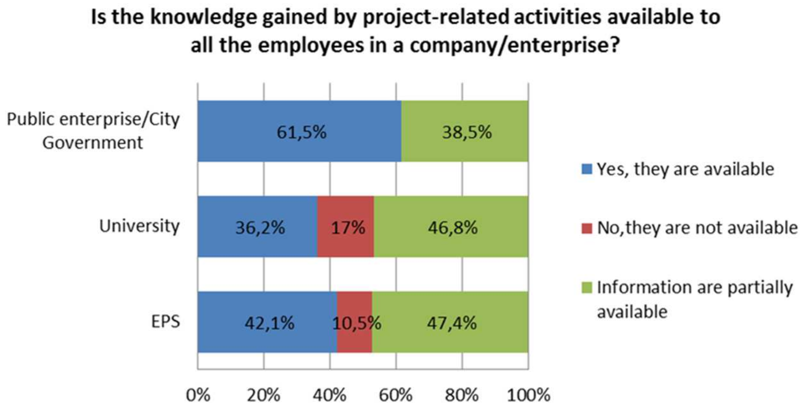
Graph 3. Significance of projects for gaining new knowledge

Having examined all three sub-samples (EPS, University and Public Enterprises/City government), at least 74% of respondents believe that the by participating in projects, people can acquire new information and knowledge in the field of safety and protection (i.e. 81.6% of the whole sample), (see Graph 4).



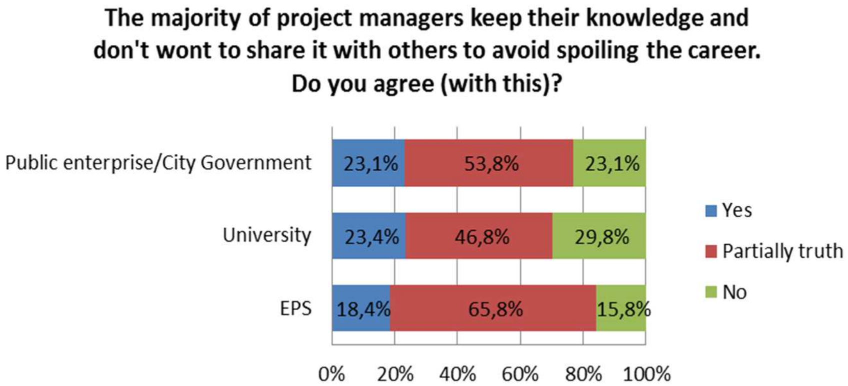
Graph 4. Knowledge in the field of safety and protection

However, it is interesting that 17% of respondents employed at the University, as well as 10.5% of respondents who work in EPS believe that knowledge gained through projects is not available (i.e. 12.2% of the entire sample), (see Graph 5); on the other hand, rather large number of respondents think that previously acquired knowledge could be used for the implementation of new projects (i.e. 81.6% of the entire sample).



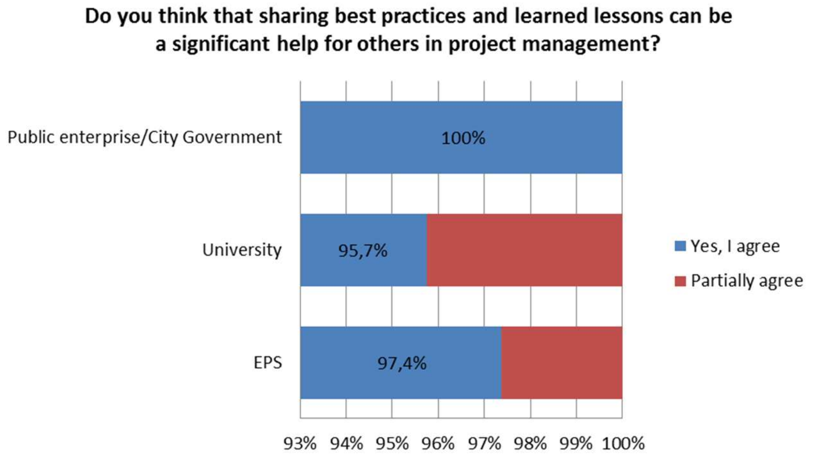
Graph 5. Availability of project knowledge and information

We wanted to know whether project managers share or keep their project knowledge for themselves while working on different projects. In case of all three sub-samples, a percentage of respondents think that managers retain their knowledge and do not want to share it (i.e. 21.4% of the whole sample), (see Graph 6).



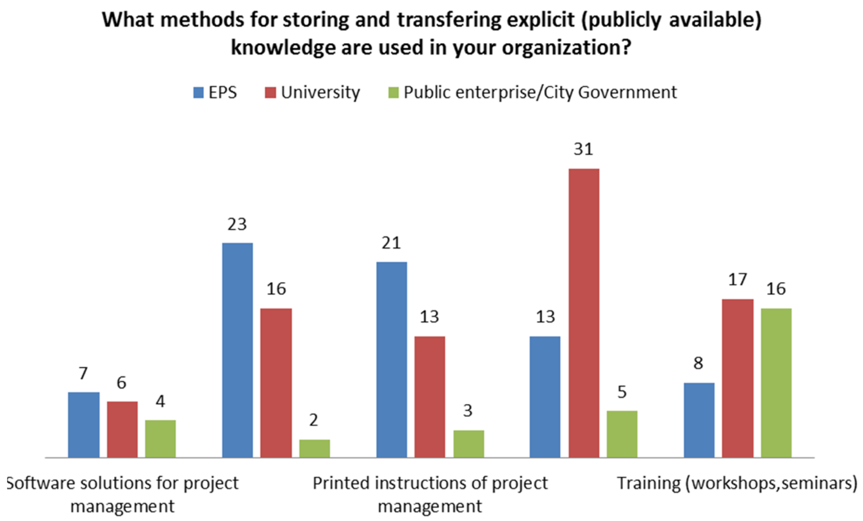
Graph 6. Project managers and knowledge sharing

In spite of this practice, it can be seen that in all three sub-areas (EPS, University and Public Enterprises/City Governments), 95% of respondents believe that sharing the lessons learned and the examples of good practice can be a significant help to others in project management (96.9% of the whole sample), (see Graph 7).



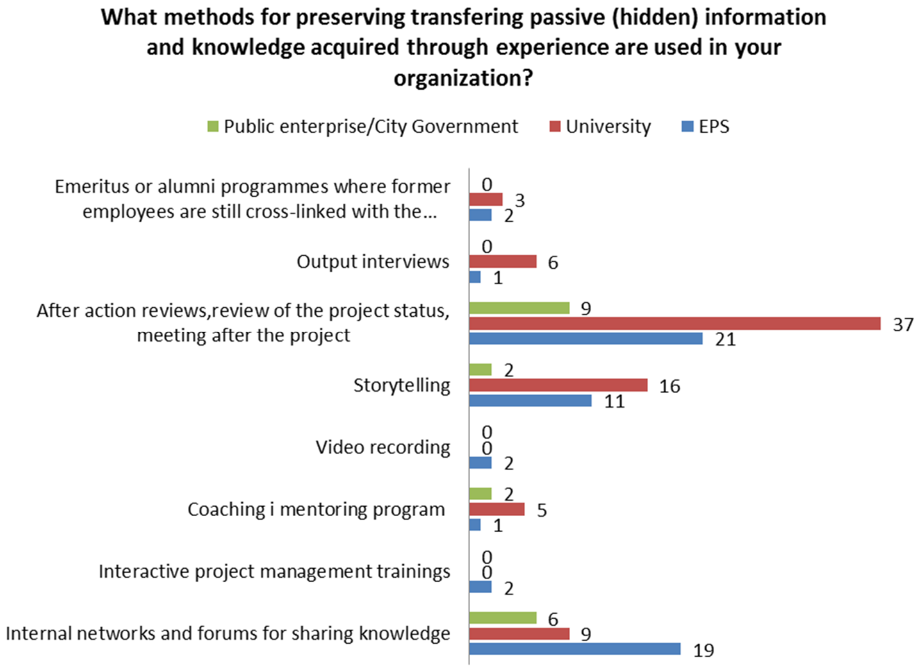
Graph 7. Help in project management

When it comes to methods for storing and transferring explicit knowledge, the obtained data indicate that the EPS employees use the Internet and portals as the method for storing and transferring publicly available knowledge; on the other hand, the employees at the University mostly share their project reports, while the employees in public companies and city governments organize trainings (workshops and seminars), (see Graph 8).



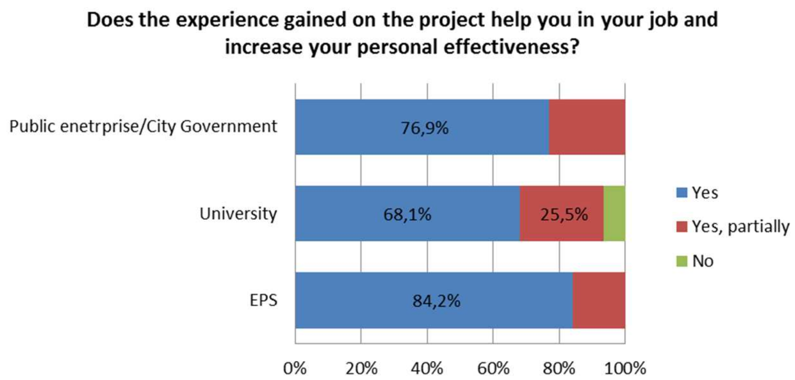
Graph 8. Methods for storing and transferring publicly available knowledge

When it comes to tacit knowledge, the employees in all observed organizations use a retrospective approach, or a review of what has been done after the project implementation i.e. after-action review. Also, internal networks and forums for storing and transferring this knowledge are worth mentioning. The results confirm the application of the narrative method which, according to many authors, is especially significant in case of sharing knowledge about safety and protection in high-risk industries (see Graph 9).



Graph 9. Methods for documenting tacit knowledge

Respondents confirm that their project experience helps them to perform their tasks more efficiently. The data obtained in all three sub-samples (EPS, Faculties and Public Enterprises / City Administrations) indicate that a certain number of respondents consider that the experience gained from projects helps them to perform better and increase their personal efficiency (i.e. 75.5% of the entire sample), or partially helps them in their work tasks (21.4% of the whole sample), (see Graph 10).



Graph 10. Learning from project experience and personal efficiency

The largest number of respondents in EPS, University and Public Enterprises/City Governments think that it is necessary to develop organizations based on project research because they enable the acquisition of new knowledge and information (Graph 11).

Graph 11. Project-based organizations

The obtained research results confirm the need for knowledge transfer in the context of project management, and the significance of project-based organizations for the development of all employees and the organization as a whole.
A particular hypothesis was focused on the differences between different organizations in terms of project engagement of employees/respondents and transferring project knowledge in the organization. We first attempted to investigate whether there were any statistically significant differences in terms of engagement of respondents in projects depending on the type of organization in which they were employed.

Table 5. Respondents' participation in projects in their work organization

ORGANIZATION	Have you ever participated in project implemented in your work organization?		Total
	yes	no	
EPS	35	3	38
University	44	3	47
Public Enterprises/ City Governments	12	1	13
Total	91	7	98

X^2 = 0,79 (df=2) Sig. 0,961

The obtained data indicate that there is no statistically significant difference between the organizations in terms of project implementation, i.e. the participation of employees / respondents in projects (Table 5). In fact, our hypothesis that participation in projects depends on the type of organization in which respondents work was not conformed.
Also, data analysis did not lead to the conclusion that the transfer of project knowledge depends on the type of organization in which the respondents work. Statistical significance is present only in terms of education/preparation for project work (Table 6). The results indicate that a significant number of respondents/university employees declared that they never had an education/preparation for project (Chi- square with 0.04 significance level).

Table 6. Distribution of respondents in terms of education/preparation for project

ORGANIZATION		Does your organization organize project-related trainings and education?			Total
		Yes, often	Sometimes	No, never	
	EPS	4	23	11	38
	University	5	16	26	47
	Public Enterprises/ City Governments	0	9	4	13
Total		9	48	41	98

$X^2 = 9,572$ (df=4) Sig. 0,048
Statistically significant organizations are distinguished when it comes to the project retrospective (meetings after project implementation).

Table 7. Project overview

ORGANIZATION		Have you ever organized meetings on project retrospective (project review, after-actions review, application of project knowledge in practice, etc.)?			Total
		Yes, often	Sometimes	No, never	
	EPS	3	33	2	38
	University	11	23	13	47
	Public Enterprises/ City Governments	6	7	0	13
Total		20	63	15	98

$X^2 = 21,47$ (df=4) Sig. 0,00
Respondents in all observed organizations stated that they sometimes had meetings on project retrospective (project review, after-actions review, implementation of project knowledge in practice, etc.). However, it is particularly intriguing that a number of respondents from higher education institutions have never organized such meetings (Table 7) The chi- square test shows that there is a statistical significance in the frequency of meetings at 0.00.
In this paper, the socio-demographic characteristics of the respondents served as control variables. For this reason, we will take a brief look at some of the obtained results that are interesting from the aspect of human resources management. In the research, we tried to find the correlation between the socio-demographic characteristics of the respondents and their work/engagement in the project and the connection between the socio-demographic characteristics of the respondents and the transfer of project knowledge in the organization. The analysis of the relationship between their sex and work/engagement on projects did not show any statistical significance.
However, respondents between 36 and 50 years of age indicated some problems during the implementation of projects (chi-square = 24,37 (df = 14) Sig 0,04). The level of education has shown statistical significance only when it comes to the character of the project (most of the respondents with a master degree are engaged in investment projects, while doctors of science are most often engaged in projects in the field of safety and protection (*X^2 = 56,29(df=20)Sig. 0,00,* according to the values of the chi- square test.) When it comes to the employment length, we can say that respondents with 10-20 years of work experience are most often engaged in projects in the field of investment and planning, while the respondents with more than 20 years of experience are mostly engaged in safety and protection projects (X^2 = 24,21(df=10)Sig. 0,00.)
From the aspect of knowledge transfer, gender has not proved to be a significant feature of project management. All age categories consider that projects are important for gaining new knowledge in the organization (chi-square test X^2 = 9,17(df=4) Sig. 0,05.). The level of education has proved significant in terms of the respondents' attitude to the availability of project knowledge (higher education level respondents are more likely to claim that only some project information is available, chi-square test X^2 = 18,01(df=8)Sig. 0,02.) Respondents with a PhD indicate that their organization never conducts

education on project-related activities (the value of the chi- square test is $X^2 = 22,21(df=8)$Sig. 0,00.) However, the respondents with higher education level point to the importance of the project retrospective (meetings and discussion on the project results, chi-square test $X^2 = 30,19(df=8)$Sig. 0,00 the examination of project roles in relation to the level of education show that the position of the manager is often attributed to those with the highest level of education.
Also, the greatest proportion of respondents with higher education is the members of the project team, which is not surprising due to the fact that the majority of the sample is made by respondents who are employed at higher education institutions ($X^2 = 64.44$ (df = 20) Sig. 0,00.)

CONCLUSION

The issues discussed in this paper are oriented towards project-based organizations and participation of employees in project (engagement of project staff) and the transfer of project-acquired knowledge. In this paper, we used the results of the empirical research carried out in various organizations: higher education institutions, organizations of the electric power system and public enterprises/city government of the city of Niš. In particular, the results point to guidelines when it comes to project management in terms of storing, transferring and sharing knowledge, which are considered to be an integral part of project management. Although the results can help us improve project management practices, the next step is to move to "triple loop learning", i.e. learning and converting current project knowledge and information production by changing the focus from transmitting information *per se* according to co-produced knowledge that is applicable by different types of users. It is necessary to provide additional guidance i to strengthen mechanisms and platforms for analyzing the existing and new knowledge. Also, it is necessary to foster essential transformation of knowledge into wisdom.

Production and transfer of knowledge occurs through project interactions which involve explicit and tacit knowledge. Therefore, it is crucial to further promote the need for knowledge transfer (organizational learning) as a significant segment of project management in an organization [24].
This requires a joint action on the development of capacities and skills for managing information and knowledge. Although we have benefited from the great access to information and the generous cooperation of all respondents, drawing conclusions has turned to be a rather difficult task due to different activities performed in the organizations observed.

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PROJECT MANAGEMENT IN ENVIRONMENTAL PROTECTION

Abstract
Strong economic and technical-technological development, industrial production and the application of new advanced technologies have contributed to the rapid development of people's living standards, but on the other hand they caused large environmental pollution and irrational exploitation of natural resources. General need has emerged to regulate the protection and preservation of the environment through the adoption of numerous environmental laws, procedures, standards and regulations relating to these projects, their design and implementation. The aim of this paper is to briefly describe the basic concepts related to the project, its definitions and characteristics, the concept of project management, as well as the legal regulations that regulates project management in environmental protection.

Key words: Management, project, environmental protection, project management

INTRODUCTION

Strong economic and technical-technological development, industrial production and the application of new advanced technologies have contributed to the rapid development of people's living standards, but on the other hand they caused large environmental pollution and irrational exploitation of natural resources. Being aware that natural resources can not be used mercilessly, without endangering or disappearing, there are increasingly loud demands for environmental protection in the world today, with emphasis not only on preserving natural values and concern for the protection of the existing, but also for ecological transformation that involves the use of natural resources on the principles of sustainable development. Starting from the fact that the man accomplished his greatest achievements through the development of projects in all areas of his activity and, thus, his environmental impact has become more and more negative, the general need for regulating the protection and preservation of the environment has been imposed through the adoption of numerous environmental laws, procedures, standards and regulations relating to these projects, their design and implementation.

With the legal regulations that are placed before projects, the understanding of the project itself and the project management process is significantly changed. Encouraged by the requirements of end-users, but also conditioned by legal regulations that are important for environmental protection, it is necessary to constantly adapt the basic models of project management, management approaches and processes to new conditions, and to harmonize them with the requirements prescribed by legal acts in the field of environmental protection. Project management is a discipline that provides the development of new products and services with the proper organization of the project and the preservation of the environment in which it is implemented. With the help of this discipline, it is possible to implement many projects in an efficient and effective way, the basic characteristics of which are target orientation, limited time period and limited available resources. In order to achieve the goals of each initiated project in the best possible way it is necessary to develop an appropriate project management concept that will enable more efficient use of the available methods, material resources, financial resources and people in the process of realization of the project. In today's business world of constant change, there is an increase in the number of projects regardless of the business activity in which they are conducted, and therefore the influence on the social and natural environment in which these projects are realized are also increased. Therefore, using the impact assessment methods, it is necessary to evaluate the main negative impacts on the project environment in order to minimize them and to achieve the highest possible environmental quality preservation.

The aim of this paper is to briefly describe the basic concepts related to the project, its definitions and characteristics, the concept of project management, as well as the legal regulations that regulates project management in environmental protection.

CONCEPT OF PROJECT MANAGEMENT

Whether it comes to the development of a new products, the entering of the new markets, the introduction of the information system and the improvement of business within the business systems, the reconstruction of the existing ones or the construction of new facilities, the protection and preservation of the environment, it always refers to the realization of a specific project and project activities that are undertaken in order to achieve certain goals in a certain area, in a quality manner, in the precisely predicted time and with the precisely envisaged realization costs.
The modern world in which we live is complex, in it there are constantly changes that arise from the need of man to improve his life and solve various problems and tasks. For this reason, a large number of different projects are being implemented (investment, military, development, organizational, social, etc.). To complete these projects, huge potentials and financial resources are needed.

There are different definitions of the project, but the essence is the same because all authors agree that each project has a lifetime and a clearly defined beginning and end, that the project ends when its goal is fulfilled and when a unique product is created. It is also necessary to undertake certain activities to achieve a predetermined and unique goal. Many definitions emphasize individual project attributes that relate to the project consisting of a series of activities, that resources are needed for project execution, that it has a structure, it is a one-time venture that has a clearly defined goal and that the project is executed in phases within a given time , with the consumption or use of a large number of different and limited available resources [2]. According to the International Commission on Standards, the project is a unique process which consists of a set of coordinated and controlled activities, with a specific start date and completion date in order to deliver the product in accordance with the set requirements, with limitations in terms of time, costs and available resources. When it comes to the specifics of the project in accordance with the international standard ISO 9004 it can be said that:
(a) that the project implies a temporary organization formed during the life cycle,
(b) in some cases, the project is part of a larger structure project,
(c) the objective of the project can be achieved or defined during the progress of the project,
(d) the result of the project sometimes requires the formation of one or more project units,
(e) relations between project units can be very complex [1].

The most acceptable project definition is provided in the Project Management Guide „*A Guide to the Project Management Body of Knowledge*“ (PMBOK) [6], which is published by Project Management Institute (PMI), the world's leading organization for the standardization of project management applications, the project is defined as "a one-time venture undertaken to create a unique product, service, or other particular result".
In order to achieve the basic goals of each initiated project and enable its realization in an efficient and effective way in as short a time as possible, with minimal costs and satisfactory quality, it is necessary to develop an appropriate project management concept that will enable more efficient use of the available methods, material resources, financial resources and people in the process of realization of the project.
The care of a civil society society for environmental issues is constantly increasing, which is manifested through the adoption of a large number of laws, procedures and standards, as well as through the development of economic, environmental and other measures for the preservation and improvement of the environment, including sustainable development, the need for efficient management system of environmental protection and elaboration of a large number of projects in the field of environmental protection. Many projects are initiated by international organizations and civil society organizations, and for their realization are provided funding from international funds and budgets of the countries in which they are implemented.

Project area

All projects are implemented in a natural, economic and social environment, provoking a variety of positive and negative impacts. Each project management model should be flexible in terms of including new processes into the model structure needed for more efficient environmental protection. If the project can affect its environment during its implementation, the members of the project team must be familiar with the ecological characteristics of the area where the project is being carried out, not only because of the environmental impact of the project, but also because of the environmental impact on the project itself [1].

PROCESSES IN PROJECT MANAGEMENT

Project management is carried out through a series of processes, and these processes produce the desired outputs using the knowledge, skills and techniques from certain inputs. These processes enable execution of project activities in order to realize the project and fulfill the it's requirements. For the successful implementation of the project, it is necessary to select appropriate processes within each group of project management processes, to harmonize requirements in terms of needs and expectations, and to balance the volume, time, costs and resources that are necessary for achieving quality results.
The process is a set of interrelated activities that are carried out in order to create a particular product, service or to achieve a particular result. Consequently, project management processes are usually presented as separate elements with defined interconnections. These elements are combined in groups which serve as a guide for the application of appropriate knowledge and skills in the project management.
Starting from the fact that the project is a time-limited venture whose life cycle takes place through four basic stages (initialization, planning, execution and closure of the project), the project management concept is based on the existence of groups of processes performed for each phase of the project lifecycle, and specific groups of processes that include monitoring and control in all aspects of the project. This group interacts with other groups, monitors and controls the tasks of the entire project. Process groups do not represent the stage of the project and can be performed and repeated for each phase or sub-phase of the project.

In accordance with the PMBOK guide, the processes used in project management are: (1) initiating processes, (2) planning processes, (3) executing processes, (4) controlling processes, (5) closing processes. Initial processes consist of processes that permit the formal approval of a project or some of its phases. Within this group of processes, the conceptual design of the project is made, as well as the previous report on the scope of the project. Planning processes describe project objectives and optimal plans for achieving these goals. This group of processes involves the development of a project management plan, planning and defining the scope of the project, defining activities and their scheduling, assessing the necessary resources, costs and duration of the activity, planning human resources and project quality, and identifying risks and planning risk management. Executing processes represent a group of processes that enable the realization of the project. These processes coordinate resources with the goal of executing the plan and achieving the objectives of the project. Controling processes control the achievement of project objectives by regularly monitoring and observing all activities and conducting control of their performance by quality, time and cost, observing deviations and taking appropriate corrective measures.
Progression from one group of processes to another group has the same characteristics as progression through the project phases. Processes are not separate and individual activities that take place only once during the process. They can be repeated several times through various phases of the project, and they are interconnected with the goals and results they create. In most cases they represent activities that overlap each other with different intensity during the duration of the project, which is the case in the phase of the project life cycle.

PROJECT MANAGEMENT AND LEGAL REGULATION OF THE EU

Managing the environment means to carry out basic strategic activities that define the planning principles and protection criteria, determine the resources and define the directions of the development of the environment. This management takes place through several long-term and interconnected processes (reduction of environmental pollution, spatial planning and rational use of natural resources, etc.). Basic principles related to environmental management includes the identification of all environmental impacts on the basis of which various environmental projects are being developed, set project goals, programs and principles, monitor the results of their implementation, and review activities in order to continuously improve the efficiency of their implementation.

EU legal regulations in the field of environmental protection

Environmental protection and environmental protection are of paramount importance in terms of preserving natural resources and enabling the development of future generations. The full involvement of the entire international community is necessary in order to solve the environmental problems.

A number of activities testify to the efforts to create a more efficient mechanism for the protection and improvement of the environment. These activities are undertaken at local, regional, national and global level. They are supported by many documents, declarations, conventions and standards that give recommendations and define rights, obligations and requirements in the processes of protection, preservation and improvement of the environment. In the field of environmental protection in Europe, the European Union (EU) is the most valuable, so its legal regulation takes precedence over state legislations.

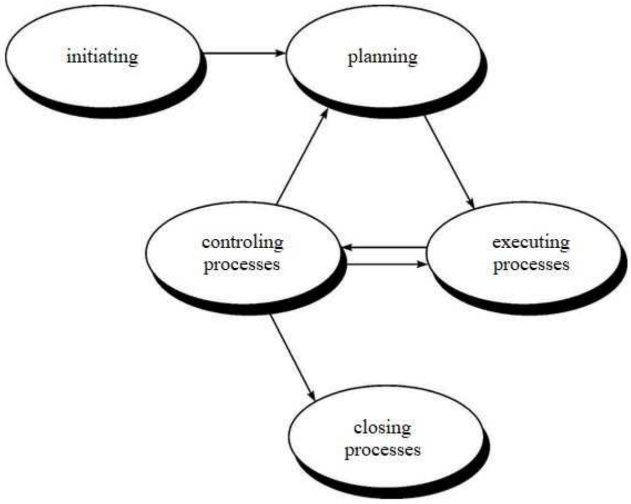

Figure 1. Connections between process groups within a certain phase of the project (Arrows specify the flow of information) [3]

The EU legal regulations in the field of environmental protection comprise about 300 legal documents classified into eleven sub-sectors representing different spheres in environmental management, which are: (1) horizontal legislation, (2) air quality, (3) waste management, (4)) water quality, (5) nature protection, (6) industrial pollution control and risk management, (7) chemicals and genetically modified organisms, (8) noise, (9) forestry, (10) climate change, and (11) civil protection [4].

Horizontal legislation includes the integration of environmental protection into all economic sectors, the strategic assessment of plans and programs, the environmental impact assessment of the projects, access to information and reporting on the implementation of environmental directives. This legislation includes a series of regulations, directives and recommendations, among which are the directives related to the assessment of the impact of projects, plans and programs on the environment. The Environmental Impact Assessment Directive refers to those projects that could have a significant impact on people, flora and fauna, land, water, air, climate, material assets and cultural heritage.

ISO 14001 Environmental management system

In response to the daily increasing concern about the environment, as well as the proportional increase in the number of laws dealing with this matter, the International Organization for Standardization (ISO) has issued a series of standards in the field of environmental protection. These international standards provide guidelines for the implementation of environmental activities, define the requirements that an organization needs to fulfill in order to provide elements of an effective environmental protection system and set up its own business in a way that can respond to growing environmental requirements.

Today, the most widespread internationally accepted standard in environmental management is the ISO 14001 standard. This standard applies to those aspects of the environment that the organization can control and which it can affect. This standard contains requirements relating to the environmental

management system. These requirements are based on a dynamic and cyclical process consisting of planning, introducing, checking and reviewing.
The basic reasons that lead to the need for ISO 14001 system are: continuous pollution of the environment, fear of total exhaustion of natural resources, lack of organized and systematic monitoring of the consequences of pollution, increased interest in public opinion for environmental protection, legal solutions, special working conditions in vulnerable areas. [5]

The ISO 14001 standard is a management tool that enables the organization of any size to identify and control the impact of its activities, products and services on the environment, improve the attitude towards the environment and implement a systematic approach that will achieve environmental goals and provide evidence that she achieved the set goals.
In order to achieve environmental objectives, the environmental management system requires that it encourage the organization to consider the possibilities of applying the best technology where possible and where it is economically free. The standard does not establish specific criteria for the environmental impact, except in relation to the obligations given in the environmental policy, that the organization will comply with legal and other requirements, and that it will work on prevention of pollution and continuous improvement. Due to the increasing awareness of the importance and impact of the environment on the survival of current and future generations, a large number of organizations have decided to introduce ISO 14001 standards, which not only shows their positive orientation towards environmental protection, but at the same time reduces their cost of resources and energy.

CONCLUSION

Man accomplished his greatest achievements by designing projects in various areas of his activity. These activities had an impact on the environment, and imposed a general need to regulate the protection, improvement and preservation of the environment through the adoption of various environmental laws, procedures, standards and regulations related to the way of designing and implementing the initiated projects.
In order to enable the development of new and innovative products or services, with the proper organization of projects and the less negative impact on the social and natural environment, a new discipline called project management has developed. Project management is the concept of applying appropriate knowledge, skills, tools and techniques to project activities to achieve project requirements. The main goal of each project's management is to provide the required technical performance and quality of the project, with a shorter time and minimal implementation costs. The essence of successful project management is to maintain a balance between the three elements: cost, quality, and execution time. Improving the quality of the results most often generates higher costs or extends the duration of the project, the faster completion of the project leads to cost increases or deterioration, while reducing the cost of a project usually requires the resilience of available resources and / or deterioration of quality.
All projects are realized in a certain natural, economic and social environment, causing many positive and negative influences. Regardless of the project management model, each of these models should be flexible in terms of including new processes in the model structure needed to more effectively protect the environment in which it is being implemented.

Encouraged by the requirements of end-users, and also conditioned by legal regulations that are important for environmental protection, it is necessary to constantly adjust the management approaches and processes and their alignment with the requirements prescribed by legal acts in the field of environmental protection.
When it comes to the environment, if the project can negatively affect the physical environment during its realization, the members of the project team must be familiar with the ecological characteristics of the area where the project is being carried out, not only because of the impact of the project and its activities on the environment, but also due to the environmental impact on the project itself, the flow of its realization and performance.

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REVIEW OF STATE OF THE ART TECHNIQUES FOR ASBESTOS WASTE TREATMENT TO SUPPORT ENVIRONMENTAL PROTECTION PROJECTS

Abstract
Over the past century, asbestos has been used as a significant material in the construction industry. Because of its durability these materials have been still preserved in the same facilities, in our environment today. Research shows that an increase in the amount of asbestos-containing waste can be expected in the coming years and decades, as a consequence of deterioration asbestos-containing materials. So far, landfilling has been the most common way of managing asbestos waste in Serbia. These landfills usually are not sanitary and are not prepared to receive this kind of waste. The aim of this paper is to analyze existing techniques for the treatment of asbestos waste in the world, as well as to point to new, modern methods that are beginning to apply.
Key words: construction, landfill, management

INTRODUCTION

About asbestos

Asbestos is a group of naturally occurring fibrous hydroxylates, given in two basic types: chrysotile and amphiboles. The first, chrysotile, is hydrated magnesium silicate that occurs in the serpentine rocks. It is the smallest type of asbestos fiber, and is mostly used in asbestos-textile industry (production of asbestos braids, yarn, platana, etc.) The second group, amphiboles, consists of five asbestos minerals: antofilite, tremolite, amosite, actinolite, and crocidolite. Commercial importance have had only the amosite, crocidolite and antofilite. Amosite is form of a magnesium silicate with lot of iron, forming hard and long fibers-up to 30 cm. Due to the hardness of fibers it is used in the manufacture of insulating materials. The crocidolite is in the form of natrium ferrosilicate and the fibers hardness is between chrysotile and amosite. Antofil represents magnesium silicate with short fibers. [1]

Different types of asbestos have different origin and composition, and according to that different physical characteristics, as shown in table 1. Same is that all types of asbestos have a large specific surface, so contamination can occur during the production and preparation of the fibers. Unprocessed asbestos may also contain certain amounts of oil, and it contains traceable metals (cobalt, manganese, nickel, chromium) known for their biological activity.

Table 1. Physical and Chemical Properties of Asbestos Fibers

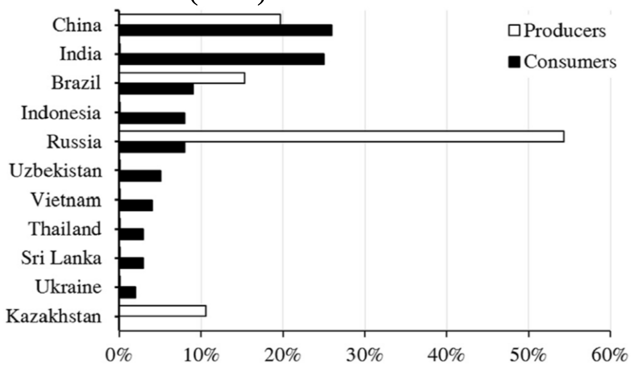
Properties	Chrysotile [12001-29-5]	Amosite [12172-73-5]	Crocidolite [12001-28-4]
Idealized chemical formula	$[Mg_3Si_2O_5(OH)_4]_n$	$[(Mg,Fe^{+2})_7Si_8O_{22}(HO)_2]_n$	$[Na_2Fe_3^{2+}Fe_2^{3+}Si_8O_{22}(OH)_2]_n$
Color	Usually white to grayish green	Yellowish gray to dark brown	Cobalt blue to lavender blue
hardness, Mohs	2.5-4.0	5.5-6.0	4.0
specific gravity	2.4-2.6	3.1-3.25	3.2-3.3
flexibility	high	fair	fair to good

tensile strength, (MPa)	1100-4400	1500-2600	1400-4600
surface charge (mV)	+13.6 to +54	-20 to -40	-32
decomposition temperature (°C)	600-850	600-900	400-900
Solubility: water solvents acids[a] (%) bases[a] (%)	 Insoluble Insoluble 56 1.03	 Insoluble Insoluble 12 6.82	 Insoluble Insoluble 3.14 1.20
Fusion temperature of residual material (°C)	1500	1400	1200

[a] Percent loss in weight due to loss of counter-ions; silicate structure remains intact.
Source: Skinner et al., 1988; Virta, 2011

Preparation of asbestos started up to 2500 years before the new era with producing materials resistant to fire, but for the modern use in industry it started only about 100 years ago. Industrial exploitation of this resource for the fabrication of spun products, rope packings, and heat insulating boards began between 1860 and 1875. Once these new goods were presented at the Paris Universal Exposition in 1878, the world production of asbestos containing products raised. As a result, asbestos extraction continued to grow steadily, peaking in 1977 at 4.8 $*10^6$ tons. [3] After the WWII sudden development as a building material due to its exceptional physicochemical features and cheapness, asbestos is becoming irreplaceable in the modern industry. Asbestos materials are distinguished by heat resistance, abrasion and tearing, and possesses flexibility and visibility and a large specific surface area. The basic uses are: production of asbestos cement, filler for plastics, insulating materials, asbestos canvas (protective clothing) and friction products. Strips impregnated with plastic materials are used for brake linings and couplings, most of coatings are made by mixing of asbestos fibers, plastics and corresponding fillers. It could be said that today there are no residential or public building, no vehicle without asbestos applied in some form and quantity. In the peak period of asbestos consumption, more than 3000 types of asbestos containing products have been used in schools, hospitals, gyms, cinemas, and industrial plants.

Fig. 1. Producers (2015) and consumers (2012) of asbestos fiber.



Source: Spasiano, D. et al., 2017

Rapid and extensive use of asbestos without knowing its biological effect on people, without any protection measures has led to disease epidemic. Today are well known asbestos associated diseases specific with exposure to asbestos fibers, such as lung asbestosis, malignant respiratory and abdominal warts, and others.

Many authors justify the use or the presence of chrysotile in non-friable asbestos containing products in public buildings, since in this condition it is not dangerous for human health. Indeed, the hazard generated by asbestos containing products is associated to the inhalation of asbestos airborne. [5,6,7,8,9] On the other hand, in Serbia a significant portion of the water distribution through asbestos cement pipes is still in service. Depending on the age of the waterworks, it is estimated that 30 to 70 percent of the main lines are with asbestos pipes. [10] North America has been reported that some water samples, withdrawn in 1991, contained between $1.4 * 10^3$-$2.6 * 10^5$ million asbestos fibers per liter. Like inhalation, also the ingestion of asbestos fibers can cause fatal diseases [11,12]. Furthermore, during natural and made-man disasters, asbestos containing products present in buildings contribute to the generation of large volumes of debris characterized by high environmental and public health impacts. Specifically, it occurred after 2005 Katrina hurricane, 2011 Fukushima earthquake and after the terroristic attack to the World Trade Center in 2001 when analysis in settled dust highlighted the presence of asbestos fibers. Moreover, non-friable and friable asbestos containing products could generate hazardous dusts during a whole-building demolition by heavy equipment and/or explosives. In any case, it has been estimated that $125*10^6$ people are occupationally exposed to asbestos and it has been reported that asbestos-related illnesses cause $1.07 *10^6$ deaths per year. [4]

Extraction and use of asbestos is being forbidden, mainly in European countries, because of its negative effects on human health. Started with Iceland (1983), Norway (1984), Denmark (1986), Sweden (1986), Austria (1990), The Netherlands (1991), Finland (1992), Italy (1992), and Germany (1993) were the first countries to restrict and ban asbestos uses. Nowadays, asbestos mining and use in 2015 was still equal to $2.0 *10^6$ tons, although 58 countries have banned the production and consumption of all forms of asbestos. Asbestos is still used in some products where is difficult to be replaced. Examples of asbestos usage are reported in Table 2. [4]

Table 2. Utilization of asbestos fibers in 2000

Category of asbestos products	Asbestos bonded with other materials		Asbestos as textile fiber	Asbestos used as loose fiber mixtures
% of total asbestos usage	>98%		<1%	<0.1%
Preparation method	bonded with inorganic materials	bonded with organic materials	rovings, yarn	mixtures with inorganic materials
Main products	Portland cement, hydrous calcium silicate, basic magnesium carbonate	oils, tars, elastomers, plastics, resins	woven, plaited	cement, gypsum, hydrous calcium silicate, basic magnesium carbonate, diatomaceous earth
Main uses	pipelines, flat sheets, corrugated roof sheeting and fencing, insulation boards	roofing products, caulking, joining, packings, gaskets, floor tiles, reinforced plastic sheets, friction materials, thermoplastics, thermosets	cloth, webbing, tubing, jointings	heat, electrical or sound insulation products

Source: Virta, R.L., 2002

Environmental protection projects related to waste management in particular categories such as asbestos waste should be based on new achievements and modern techniques. Therefore, the present state and type of management of asbestos containing waste in Serbia, as well as the review of new available techniques, commercially used and those still in the testing phase will be outlined in the paper.

METHODS

Asbestos in Serbia

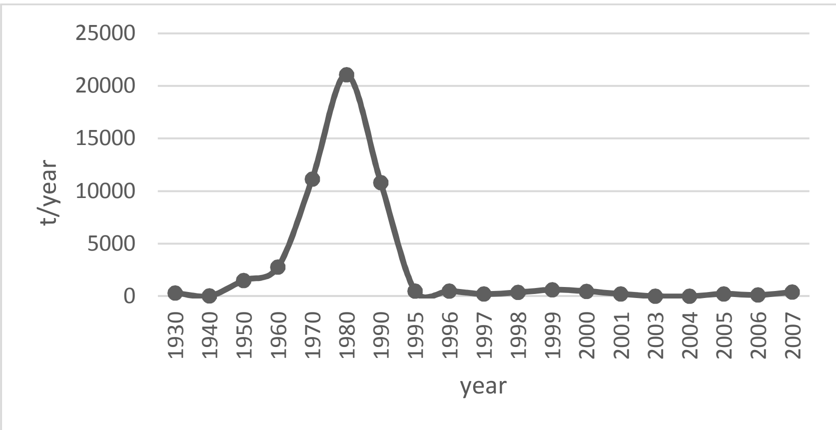
The main period of asbestos usage in Serbia was in the beginning of the 20th century, as it is shown on Graph 1. It can be explained by the fact that asbestos was a new material with good qualities and one still did not know its dangers. The highest consumption of asbestos was recorded between 1975 and 1985 for Serbia. During the 90s Serbia was under sanctions and war, followed by Europe's and world bans on using asbestos, which is reflected in the declining use of asbestos (Graph 1).

Main reason for this massive use of asbestos is the fact that Serbia had two mines of chrysotile located in asbestos-bearing zones: Kopaonik (Korlace) and Sumadija (Stragari) and was largest European producer and exporter. Both mines have ceased to operate, without any proper methods for saving surrounding environment. Last available figures are that 4080 t asbestos was produced in 2005 and 4500 t in 2006. [14]

In Serbia Asbestos is widely used in construction, for pipes and roof coverings, as well as for insulation of ships. The products from asbestos were produced by the companies: "Jugoazbest" (later "Cobest") Belgrade and "Fiaz" company from Prokuplje. [10]

Such a great usage results in the producing of large amounts of waste. There is no systematized information on the quantities of generated waste containing asbestos until 2009, when Waste management law is adopted and all data about generated hazardous waste must be submitted to the Agency for Environmental Protection.

Graph 1. Consumption of asbestos in Serbia 1930-2007



Source: own source

According to available data from the Statistical institute of Serbia and the Agency for environmental protection for the period 2010-2014, in the Table 3 are shown official quantities of generated, landfilled and treated asbestos waste. [10, 15-20]

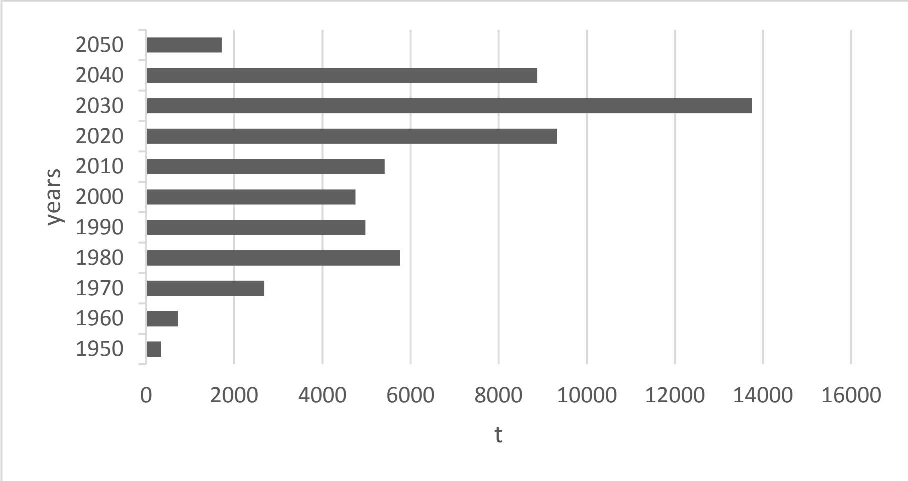
Table 3 Generated, landfilled and treated asbestos containing waste 2010-2014

Year	Generated (t/y)	Landfilled (t/y)	Treatment (t/y)	Export of asbestos (t/y)
2010	516.6	1034.9	-	-
2011	400.9	2627	-	315
2012	240.24	306	17.1	-
2013	191.83	279	30.47	-
2014	-	287.31	27.54	-

Source: own source

Estimated quantities of generated asbestos waste are actually far greater, as is shown in below.

Graph 2. Estimation of asbestos waste that will be generated in future for Serbia



Source: own source

Graph 2 shows the amount of asbestos containing waste, and it can be seen that quantities of waste grows from the 50s in 20th century. The sharp rise and fall in proportion to the amount of waste follows the trends when it comes to the use of asbestos in the past. The largest amounts of waste are expected in the coming 10-20 years, as asbestos built in constructions during 70s and 80s will be ready for replacement due to deterioration. For 2030 year it is estimated that 13,488 t of waste will be generated. After 7,572 t waste that will occur in 2040, amounts drastically decrease as a result of sanctions during 90s, followed by ban on use of asbestos.

So far, as shown in table 3 landfilling has been the most common way of managing asbestos waste in Serbia. These landfills usually are not sanitary and are not prepared to receive this kind of waste. Furthermore, landfilling is conflicting with the idea of sustainable land use, recycling, and closing material cycles. [4]

Table 4 Number and locations of companies with permissions for landfilling and treatment

Waste catalog number for asbestos	Landfilling permission	Treatment permission
06 13 04*	Jagodina, Belgrade, Kikinda	Belgrade-2, Kikinda
17 06 01 *	Jagodina, Belgrade, Kikinda	Kikinda, Belgrade-2
17 06 05*	Jagodina, Belgrade, Kikinda	Kikinda, Sombor, Belgrade-2
15 01 11*	-	Belgrade-4, Kikinda, Valjevo
16 02 12*	-	Kikinda, Belgrade-3, Niš,Valjevo, Sombor,
16 01 11*	-	Kikinda, Sombor, Belgrade
06 07 01*	-	Kikinda, Belgrade
10 13 10	-	Šabac, Kikinda, Valjevo,Ub, Kragujevac, Belgrade-2
10 19 09*	-	Kikinda, Belgrade-2

Table 4 shows number and locations of companies with permissions for landfilling and treatment according to waste catalog number of different asbestos wastes. Data on licenses are downloaded from the Serbian environmental protection agency website (16.03.2018.). It can be seen that only two types of asbestos waste have permission to dispose of in Serbia. On the other hand, there are a number of companies that have licenses for some kind of treatment. However, there is no data on the type of treatment or the quantities for companies annually process (actual processed quantities of asbestos waste).

According to the document National profile of asbestos exposure for republic of Serbia, by Ministry of health of Serbia, there are three sanitary landfills for disposal of asbestos-containing waste, which are Lapovo, Kikinda and Leskovac. While the sanitary landfill in Jagodina has a permit, but there are no technical possibilities for disposal of this type of waste. Also, according to the Decree on Disposal of Wastes to Landfills, it is possible to dispose construction waste containing asbestos and other asbestos waste that meets the requirements in accordance with special regulations, that it does not contain other hazardous substances except asbestos, and that the final landing is placed at the landfill avoiding the spread of fiber. For such landfills a location plan with precisely indicated micro locations of cassettes in which asbestos is deposited is kept, even after the closure of these landfills. Storage of asbestos containing waste is possible under strictly controlled conditions and such waste in the warehouse must not be kept for more than 12 months. [10]

Despite the existing legislation on waste management, in the Republic of Serbia, the so-called wild dumps where the building material that is created during demolition and renovation of private residential buildings are common. Considering that the excavated building material from residential buildings built after WWII, most likely contain asbestos, this method of eliminating construction waste represents a health risk for residents in areas where wild dumps are located.

There is some kind of asbestos waste treatment in Serbia, the question is how much is actually processed and what is done with the residuals (landfilled, reused, etc.) Whether one treatment is suitable for the region, or for the type and amount of generated asbestos waste, is determined by several criteria. First of all, the limitations are related to the price, the efficiency of the process, the sustainability, the output of the material at the end (the activity of asbestos fibers). This will be the subject of further research, as well as a proposal for the best solutions for Serbia, while in this paper the state-of-the-art methods are presented.

RESULTS

Solidification and stabilization

The landfilling of hazardous waste following the solidification and stabilization treatments is considered as a safe and appropriate waste management strategy. [4]
Solidification and stabilization treatments are designed to improve the material handling by forming a compact structures that are less active. As a result, the reduction of mobility and release of hazardous constituents, the decrease of the exposed surface area, and the reduction of porosity and permeability of the waste are obtained. [4]
Hereby, solidification and stabilization treatments could be adopted as pretreatments for friable asbestos containing waste before its landfilling. For example, asbestos waste from an automobile brake manufacturing facility were effectively encapsulated in a cement matrix and in polymeric resins. These are simple ways to immobilize the unbound asbestos fibers thus removing the direct threat. On the other side, they do not eliminate the hazardous characteristics of the fibers and do not result in a re-usable product at the end of the lifetime. [4]
On the other hand, the encapsulation may be useful for asbestos management in private and public building because this method does not require the removal of the asbestos containing products. [4]
Practice of applying organic or inorganic stabilizers by airless spray equipment to asbestos containing materials prevents and reduces the release of asbestos fibers. As an example, it has been recently proposed an innovative in-situ encapsulation of asbestos fibers generated by trenchless pipe bursting during the replacement of asbestos cement pipelines. The macro-encapsulating material, which absorbs and immobilizes asbestos fibers and pipe fragments, is applied simultaneously as the pipe bursting operation proceeds, as by pumping the stabilizer out through nozzles located near the pipe bursting head. Another field of application of the encapsulation methods is to stabilize the surfaces of asbestos containing products within the buildings. Encapsulation does not provide a lasting solution since the

asbestos remains in the building. For this reason, the encapsulated material must be checked periodically to ensure that the encapsulated material has not been damaged. Moreover, stabilizers, once applied, will deteriorate over time and the need of for recoating will recur periodically throughout the life of the building. [4]

Vitrification

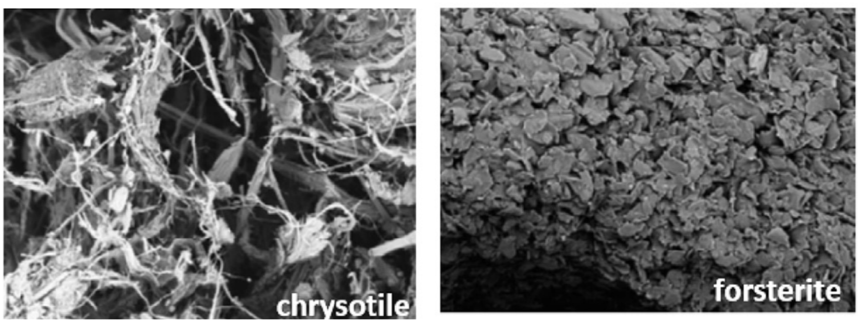
The vitrification consists in the conversion of the waste in a stable and homogeneous silicate glass by means of a thermal treatment, which leads to the merging of the media. In particular, the extreme temperatures typical of this process (1200-1600°C) can completely destroy the asbestos fiber structure, transforming an asbestos containing waste into an asbestos free and vitrified end-product. [4] This process not only destroys the harmful asbestos fibers, but also reduces the waste volume to landfill since part of the end-products can be reused. As a matter of fact, asbestos vitrification by plasma gun, carried out at 1600 °C, may result in 49% and 30% reduction of volume and mass with respect to the original values. The end-product resulting from this treatment is a fiber-free rocklike material (Cofalit) having a Mohs surface hardness of 6. Inertam a company of Europlasma Group, adopted this technology into a fixed large-scale industrial plant for asbestos containing waste conversion.

Cofalit can be used as quartz and basalt replacement in the construction industry and is sold for 10 €/ton. In particular, such vitrified asbestos containing waste can be used for the production of glass ceramics without any mineral additive and glass ceramic stoneware by adding industrial clay. Vitrification of asbestos containing waste can be also carried out by means of Joule heating. This technology is particularly interesting since it may be used for the in-situ remediation of soils contaminated with asbestos containing waste. Treatment by Joule heating vitrification may be carried out in industrial installations as the GeoMelt® treatment plant in Japan. This plant, designed for the treatment of radioactively contaminated wastes, can effectively destroy the asbestos fibers and reduce the volume by approximately 80% with respect to the initial asbestos containing waste volume. The major drawback of the vitrification processes is the use of electricity as the energy source which negatively influences the cost of the treatment. On the other hand, the main economic advantage of vitrification of asbestos containing waste lies in the cost savings related with landfill tax avoidance and the added value of the marketable end products. Indeed, it has been estimated that only $5\%_{(w/w)}$ of the input is landfilled. [4]

Thermal treatments

Asbestos fibers are unstable at high temperatures. At 500-600°C chrysotile the most used asbestos type, starts losing the hydroxyl groups and is transformed into forsterite, which recrystallizes at 820°C. [4]

Figure 2 Chrysotile before and after thermal treatment, converted to forsterite



Source: Spasiano D. 2017

Similarly, tremolite fibers, which belong to the amphibole asbestos group, undergo a dehydroxilation process at 950°C which leads to the formation of metatremolite. [4]

On the other hand, the thermal decomposition of an asbestos cement composite, which represents one of the most used asbestos containing product, differs from the transformation sequence of pure asbestos minerals due to extra crystalline reactions. However, the resulting end-products, deriving from a temperature ramp reaching 1200°C, are mainly constituted by $SiO2$ and CaO (about $40\%_{w/w}$ each), with a chemical structure similar to a Mg-rich clinker, and seems to be harmless. [4]

It is possible to transform the asbestos fibers into harmless and reusable end-products by adopting operating temperatures lower than those used in the vitrification processes. For example, the Cordiam process was suggested for the production of ceramic-type materials from the firing process of asbestos containing waste and clay mixture at 800-950°C. Moreover, it has been reported that both friable and non-friable asbestos containing waste samples, once added to silica and feldspar, and after 1 h of firing at 1100°C, were converted into a Ca and Mg-based glass ceramic which was recycled (5-10$\%_{w/w}$) into a mixture for the preparation of porcelanised gres. Such product showed technological properties better than the sample prepared without additive. A further improvement of the process are also available and commercially used end-product called KRY·AS was used for the production of clay bricks, rock-wool glasses, glass-ceramics, pigments for bulk ceramic tiles and for ceramic glazes, and finally as an inert filler for polypropylene-based composites. [4]

On the other hand, after 2 h at 700°C, also the calcination of cement-asbestos samples, containing chrysotile and crocidolite, resulted into harmless end-products. In this case, the energy consumption should be reduced, since the treatment temperature is lowered from 1200°C to 700°C, and the end-products could be reused as in the previous examples. In fact, the addition of 5$\%_{w/w}$ of such a calcined cement-asbestos material for the clinker bricks manufacture does not yield significant variations to the standard production parameters. [4]

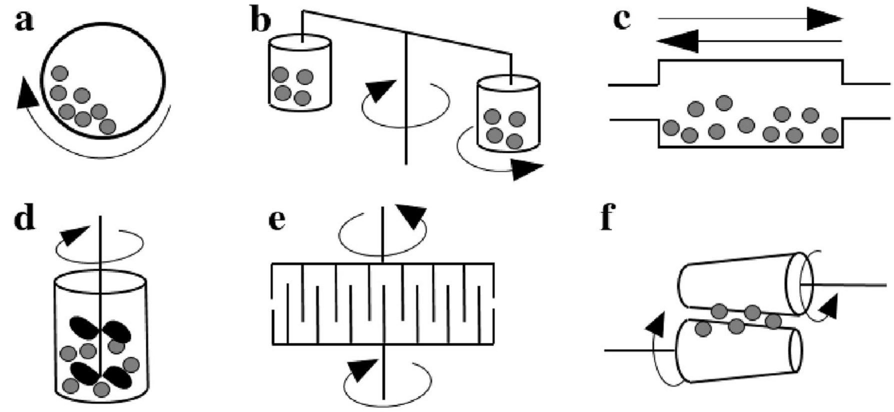
A lowering of the treatment time and/or temperature could be reached by adopting the hydrothermal treatments, which are characterized by the addition of water as sole reagent. By using a supercritical steam (T=500-700°C; P=1.75-7.40 MPa), chrysotile fibers deriving from the Asbestos Mines of Northern Greece were completely converted within 3 h at 690°C and 1 h at 700 °C. Also in these cases, chrysotile was converted in forsterite. [4]

Microwave thermal inertisation of asbestos containing waste has been proposed as alternative to the thermal treatments carried out with conventional ovens and plasma technology, since these wastes are generally characterized by a low thermal conductivity. Matter-of-fact, microwaves act in the bulk and induce a fast and uniform temperature rise. Moreover, the lightweight microwave oven can be transported and put into service in asbestos contaminated sites, thus reducing asbestos containing waste transport costs and avoiding the accidental release of asbestos fibers in the environment. At this purpose, after the Tohoku earthquake in 2011, a microwave rotary furnace was set up in Natori City (Japan) with the aim of treating the asbestos containing waste found among the debris of collapsed buildings. This full-size apparatus successfully processed 84 kg $h^{-}1$ (2 ton $d^{-}1$) ASBESTOS CONTAINING WASTE by using a rotary kiln. Even if these processes result to be cheaper than the vitrification ones, their main disadvantages are the high energy consumption, due to the high operative temperatures and the prolonged treatments. Moreover, the exhausted gases produced during these processes need to be purified, since they may contain asbestos fibers. [4]

Mechanical treatments

Mechano-chemical treatments belong to the category of chemical physical processes, concerning with chemical and physico-chemical transformations of substances in all the aggregation states produced by the effect of mechanical energy. Since lower reaction temperatures and increased reaction rate characterize these treatments with respect to the thermal processes, these operations are frequently used in many field of human activities, including the waste treatment. At this purpose, different types of mills were proposed as a function of different working regimes (figure 3). In the case of asbestos treatment, grinding tests carried out using a lab-scale ring mill operating at 250 rpm, demonstrated that pure samples of asbestos fiber and asbestos-cement composites are transformed into harmless end-products within 12 min treatment. Particularly, chrysotile and amphiboles (crocidolite and amosite) were converted into an amorphous phase in 4 min and 8-12 min respectively. The end-product of these processes are asbestos free powders, which could be reused for the preparation of mortars. Gas and dust pollutions from mechano-chemical reactors are extremely limited because operations are restricted in a close and limited environment. In continuous industrial reactors, which allow an airflow inside the system to accelerate the processes, a treatment of the exit gasses must be carried out in order to remove the suspended asbestos fibers. [4]

Figure 4. Mills types adopted in mechanochemistry; a) ball mill; b) planetary mill; c) vibratory mill; d) stirring mill (attritor); e) pin mill; f) rolling mill.



Source: Balaz, P. et al, 2005

Chemical treatments

Asbestos fibers could be denatured through a chemical treatment consisting in a water dissolution of the metals present in their crystal structures. [4]

As an example, chrysotile fibers are completely dissolved in an aqueous solution containing fluorosulfonic acid. [4]

A very similar approach was adopted for the denaturation of chrysolite, crocidolite and amosite fibers by means of the gas generated by the thermal decomposition treatment of chlorofluorocarbons.

The selection of non-toxic and less expensive reagents, such as oxalic acid as leaching acid, and tetraethoxysilane, resulted in the destruction of pure chrysotile fiber structure and the consequent production of amorphous phase silica and glushinskite. On the other hand, by using the potassium silicate instead of tetraethoxysilane, glushinskite was not produced, but the asbestos fibers were encapsulated and inactivated through a vitrification layer around the material, establishing this treatment as a potential candidate of an onsite treatment. [4]

The chemical denaturation of asbestos fibers could also be carried out in absence of reagents that do not interact with silicate layers. Indeed, it has been reported that the simple dissolution of brucite layer by means of organic (formic, acetic and oxalic acid) or inorganic acids (sulfuric, nitric, hydrochloric acids) turns the asbestos fibers into harmless end-products (magnesium salts and amorphous silica) also at room temperature. The chemical dissolution of the brucite layer could be enhanced by subjecting a chrysotile acidic suspension to the action of power ultrasound at 19.2 kHz. In fact, the observed synergy may result from the chelating action of oxalic acid on the surfaces newly exposed by ultrasound and therefore All these chemical digestion treatments were carried out on pure asbestos fibers. Regarding the asbestos containing waste, and, more in particular, the cement-asbestos wastes, the chemical digestions will take place in two ways: the chrysotile decomposition and the dissolution of the other constituents. This aspect is fundamental because, in the case of cement-asbestos wastes, a large portion of the adopted acid will be used to react with portlandite (Ca(OH2)) and calcite (CaCO3), which are the major constituents of the cement matrix. At this purpose, with the aim of reducing the cost related to the acid consumption, a thermochemical process adopting an aqueous solution of wasted sulfuric acid deriving from an electronic company in South Korea was proposed for the treatment of cement-asbestos wastes. [4]

A similar approach could be used for the chemical treatment of amphibole asbestos fibers with chelating agents. Indeed, it was reported that it is possible to decrease the toxicity of crocidolite fibers suspending them in saline solutions containing chelating species capable of extracting Fe cations from the asbestos structure. However, the complete crocidolite denaturation would require too much time and the adoption of different chelating agents, as citrate, oxalate, ascorbate would result in a further increase of treatment duration. [4]

Another fascinating asbestos containing waste chemical treatment consists in the use of asbestos and cement-asbestos wastes as resources for the CO_2 capturing and storage. Indeed, at varying operative conditions, such as pressure and temperature, chrysotile fibers can react with dissolved CO_2 leading to the production of carbonate and magnesium rich minerals as, talc, and hydromagnesite. However, both solid-liquid and solid-gas carbonatization treatments require an asbestos containing waste thermal pretreatment at 650-700 °C to reach an appreciable conversion of the asbestos fibers. [4]

Biological treatments

Even if asbestos is harmful for many animal species and generates adverse effects on foliar nutrient status of flora growing close to asbestos mines or production plants, many studies have been dedicated to asbestos fiber weathering in presence of fungi, lichens, and bacteria. In particular, some fungi excrete siderophores or other chelating molecules, which can extract iron ions from asbestos fibers, thus reducing their toxicity. [4]

As an example, Verticillium sp., grown in a crocidolite suspension, extracted 7.3% iron from the asbestos fibers within 20 days and, moreover, suppressed the production of the high oxidative HO^- radicals which induce DNA damages. Similarly, it was observed that lichens, composite organism that arise from algae and/or cyanobacteria living among filaments of multiple fungi, can grow on chrysotile-containing serpentinite rocks or asbestos cement roofs colonizing sites with protruding chrysotile fibers and disrupting the underlying material. The key step of this mineral weathering mechanism consists in the secretion of chelating compounds, as oxalic acid, secreted by lichens (as example, Acarospora cervina, Candelariella aurella, and Candelariella vitellina) during their metabolic activity. Indeed, oxalic acid can extract $Mg2^+$ ions from chrysotile fibers forming a soluble organic acid (glushinskite) which can be easily leached during rainfall events. However, since the activity of lichens is limited by hyphae anchorage depth (sometimes >2 mm) and only occurs under the surface they cover, the possibility of treating asbestosecement roofs in situ is remote because only in rare cases a 70% lichen covering was observed. Moreover, the growth of lichens is very slow and no effective techniques are currently available for increasing lichen colonization on these substrates. [4]

On the other hand, also bacteria can secrete siderophores and others chelating substances, but their growth is faster and easier to manage in comparison with fungi and lichens. Indeed, it was reported that the bacteria Bacillus mucilaginosus promoted a serpentine rock dissolution through a biologically induced process. [4]

Their metabolic activity leads to the production of organic acids and other organic ligands that facilitate the silica and magnesia dissolution. Consequently, after 20 and 30 days contact time between a Bacillus mucilaginosus culture and serpentine rocks, XRD analysis and an increase of amorphous contents. Asbestos bioremediation by bacterial species, isolated from asbestos contaminated soil and asbestos rocks, has been recently proposed. Even if these bacteria lead to a decrease in the iron content of tested asbestos samples, thus reducing their toxicity, none of the investigated species has been able to disrupt the magnesiumesilicate framework of asbestos. [4]

On these basis, the biological treatment of asbestos containing waste is now unsuitable not only because it does not completely remove asbestos fibers, but also because asbestos is generally bonded to inorganic materials, as cement, which can further decrease the process efficiency. [4]

However, an innovative bio-chemical process has been recently proposed. By this treatment, a strong dissolution of the cement phase of asbestos-cement wastes is obtained by the lactic acid deriving from the metabolic activity of Lactobacillus casei and/or Lactobacillus plantarum on exhausted milk whey.

Moreover, at the end of the biological treatment, a pH close to the optimal conditions ($1 < pH < 3$) for a following hydrothermal treatment (T= 120-150 °C, P =5-20 bar) was achieved, thus reducing the consumption of reagents. A similar process, adopting the dark fermentation as pretreatment for a sustainable hydrothermal denaturation of cement-asbestos composites, has been recently proposed. Particularly, the dark fermentation pretreatment has been successfully applied to dissolve the cementitious phase of a composite, simulating a cement-asbestos waste, and to produce a renewable source of energy, the bio-H_2, supporting the hydrothermal phase. Therefore, the proposed process should be able to decrease the acid consumption and the energy costs during the hydrothermal phase. [4]

DISCUSSION

Table 5 shows a comparative analysis of the advantages and disadvantages of each process described in the chapter Methods. Also, the final destination and prices are displayed, where possible.

Table 5. Summary of asbestos containing waste treatments

	Treatment	Final destination of end-products	Advantages	Disadvantages	Costs
Solidification and stabilization	Conditioning in cement matrix	Landfill	These processes are applicable to any asbestos containing waste	The asbestos fibers are not removed and the amount of waste to landfill increases	50:50 ratio 350-500 $/t
	Conditioning in polymer matrix	Landfill			50:50 ratio 4500$/t
Vitrification	Plasma gun	Manufacturing of glass ceramics	These processes can treat any asbestos containing waste	Very high energy consumption	$1.0 * 10^3$-$2.5 * 10^3$ €/ton depending on the asbestos containing waste composition and water content.
	Joule heating	Building industries			-
Thermal treatments	Conventional oven (800-1200 °C)	Production of clay bricks, rock-wool glasses, glass–ceramics, pigments for ceramic products	Adoption of conventional reactors and industrial plants	High energy consumption; these processes were tested only on asbestos cement wastes; the exhausted gas produced during these processes need to be purified	146 (€/ton)
	Conventional oven (700 °C)	To be defined			-
	Microwaves oven	To be defined			-
Mechanical treatments	Energetic milling	Preparation of mortars	Adoption of conventional reactors and industrial plants; mild operative conditions	High energy consumption; only asbestos cement wastes were treated; the treatment of the exit gasses has to be carried out in continuous reactors	239(€/ton)
Chemical treatments	Acid attack	To be defined	Moderate energy consumption	High reagents consumption; these processes were tested only on asbestos cement wastes; there fate of the end-products has	-
	Solutions with chelating agents	To be defined			-
	Synergic ASBESTOS CONTAINING WASTE detoxification and CO_2	To be defined			-

	capturing and storage			yet to be evaluated	
Biological treatments	Fungi	To be defined	Low energy and reagent consumption	These processes are to slow and were tested only on asbestos cement wastes	-
	Lichens	To be defined			-
	Bacteria	To be defined			-

Source: Spasiano, D. et al 2017; Chan, Y. M. 2000

As landfilling is the most common waste management option when it comes to asbestos waste in Serbia, it should be noted that proper disposal of one ton asbestos containing brakes is approximately 250 $/t (packed in double bag and sealed in 200L barrels). [22] However, no certainty is placed on the long-term leach stability of the constituents present in the dust through this disposal procedure. There is still a danger to the environment and people if the integrity of the packaging is violated, as the asbestos fibers are free.

When considering the output of the asbestos waste treatment process, it has been shown that after vitrification, thermal and mechanical processes obtained product can be returned to the industry as a raw material. While, after the solidification and stabilization processes it ends on the landfill, but in a significantly safer form than in a direct deposit. For chemical and biological methods, more research is needed.

Also, not all treatments are tested for all types of asbestos waste, and further research is needed, for example, chemical and biological treatments.

The use of energy is doubtfully high for processes such as vitrification, thermal and mechanical, on the other hand thermal and mechanical processes can be used in already installed existing systems like conventional reactors and industrial plants.

Mechanical treatments regarding the costs, the milling of asbestos containing waste is more expensive than the thermal treatments. However, the adoption of a combined mechano-thermal treatment would save the 25% of the costs. In that case mechanical –thermal treatment costs 194 (€/ton). [4]

The prices shown in the table do not include all costs: different operating costs, fees, etc, and also requires additional research.

Based on current regulatory requirements in Serbia, the alternative options are not an economically viable. However, for the quantities of asbestos waste forecasted in the coming years as shown above, it is necessary to strategically support existing systems who can treat asbestos and change it into safer form (such as companies that already have treatment permits). Also, it is important to invest in new, or improved, solutions like those shown in this paper.

CONCLUSION

The authors describe the most relevant actions related to treatments of asbestos containing waste available in literature review.

According to recent policies in Europe related to the reduction of waste to landfill, since 2013 the EU Parliament is promoting and supporting research for sustainable alternatives to deactivate asbestos containing waste and to limit their landfilling.

Nowadays, in world some alternative asbestos containing waste treatments, as vitrification (Inertam and GeoMelt®), are already applied in industrial scale plants, or in pilot scale, as in the case of the thermal (Cordiam) process. Unfortunately, these processes result to be very expensive when compared with landfilling because they require high energy consumption. However, these few industrial or pre-industrial application demonstrate that the thermal detoxification of asbestos containing waste may be an environmentally friendly alternative to landfilling. Moreover, the results found in literature and reported in this paper supports further research in the denaturation of asbestos containing waste to advance in the field of waste management projects (thru commercial and industrial processes). Truly, many thermal, hydrothermal, physical, chemical, and even biological processes have been proposed in recent years for this kind of waste.

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RISK-BASED SYSTEM MANAGEMENT

Abstract
The management of a risk-based safety and occupation system can be viewed both as a process and as an organization. As a process, it encompasses the stages of planning, execution and control. As an organization, it presupposes the existence of certain function carriers. When it comes to processes and function carriers of risk-based system management, they are sometimes difficult to determine. On the other hand, stakeholders need to be able to react and make decisions quickly in order to overcome the stress present in all participants in a given situation. The paper explores the unique nature of managing a conventional system and risk system.

Key words: risk management, occupational safety

INTRODUCTION

The differences between managing a risk-based system and conventional management systems primarily include operational regimes (stationary, alert, risk, post-risk regime), organizational structure (adaptive and elastic multi-structural organization), the nature of information (comprehensive, vague, insufficient for proper decision-making), aims (maintaining the quality in emergency conditions), criteria (minimum: losses, investment in prevention, response time in case of an emergency) and decision-making (team, collaborative), [1], [2].

The variety and complexity of tasks that arise in managing risk-based systems are connected to the need for their rapid resolution, which imposes specific demands in the planning and design process.

Planning is the best way to neutralize and minimize consequences. Project management is of the best methodologies for high-quality planning and execution. The planning stage in complex systems needs to take into account the realistic influence of hazard and is comprised of planning in normal conditions (strategic planning) and planning in extreme conditions (operational planning).

RISK AND QUALITY

The development of technologies and economic relationships in the globalization processes opened new possibilities for the increase in the social standard, but simultaneously created conditions for new risks and uncertainties in the quality of products, services, life, safety and human health. In modern practice, the prevalent viewpoint is that the technical and technological changes created new risks and increased the nature, scope and complexity of traditional risks on the one hand, and enabled a more efficient way to manage them on the other.

The presence and permanent generating of risk of various nature and origin, the threats and challenges which can undermine the safety of people, natural resources, society and entire countries point to the need to create a well-planned, comprehensive, timely and long-term system of environment management. Nowadays, there are very few international organizations that have not formulated clear goals and standards in terms of product/service quality i.e. that do not show an interest in certain issues of security and safety in their practical activities, [3].

Despite their clear benefits, new technologies bring with themselves risks that are anything but insignificant. They can be found not only in societies that are characterized by prosperity and freedom (which makes these technologies available in practice), but are also detectable in repressive societies. Consequently, we need to adopt new approaches and standards in the accomplishment of the desired level of quality of life and creation. That fact that quality is based on market orientation is confirmed by the very definition of quality – quality is defined as the set of properties and characteristics of a product or service which relate to their ability to satisfy predefined or expressed needs. The harmonization of the economic conditions at a desired level of quality highlights the need to standardize such conditions in order to minimize the consequences of potential loss or damage.

System quality is the desired state or the outcome of system operation, whereas the non-preferred changes in quality are treated as loss or damage. Loss can be various in nature – economic, financial, political, social, environmental, health or even human loss. An event which causes loss is defined as a risk event and can be a consequence of system risk, [4].

The result of an analysis of the interdependence between system quality and loss helps to define risk as a *condition in which there is a possibility that a non-preferred change will appear in system quality.* Defined in such a way, risk represents a qualitative function which describes loss. However, much more significant in practice are quantitative descriptions of functions, which is why the notion of risk is most commonly used to describe the expected value of risk which represents the product of risk event probability and the measure of loss by the non-preferred system quality change.

A systemic understanding of risk asks for a new approach to exploring the issue of risk management as an inseparable aspect of quality management, [5]. Risk management is a quality management aspect which has a supporting role in achieving required system quality. The main objective of quality management is the implementation of a strategic management plan that ensures required system quality. The goal of risk management is to preserve system quality in case of possible risk events. Risk management should ensure the continuous existence of the system, [6].

There are various definitions of risk in different scientific disciplines. Researchers adopt them based on the purpose and goals of their research. However, all these definitions of risk contain two basic determinants – indeterminacy and loss. Risk can only exist if there are at least two outcomes of a single event and at least one of them is undesirable. This points to the existence of multiple outcomes of a single event and causes indeterminacy. The outcome of the given event that differs from the desired constitutes the possibility of loss, [4].

The subjective foundation of risk relates to Man and his decisions in potentially dangerous situations. While certain events, such as natural disasters, occur independently of human will, Man plays a central role in many of them. Humans can decide to build or not to build nuclear power plants, maintain or not maintain technological systems, take care or not take care of their health. Man's attitude to risk, i.e. the psychological aspect of risk is the reflection of culture and the relationship toward him/herself and the world in which he or she lives. The research into this relationship shows that the subjective risk space is most often two-dimensional. One dimension characterizes objective threat or vulnerability, while the other dimension refers to the degree of human participation in the creation and/or prevention of dangerous situations. Therefore, it is the new risks, for which there are no adequate or efficient control measures, that have the ultimate priority for humankind.

The traditional approach, present in the probability theory, presupposes a state in which a system is affected by a multitude of factors, which are, due to our limited knowledge, considered to be random. This approach is the consequence of our limited ability to analyze cause-and-effect relationships and to come to conclusions regarding the consequences of known causes, rather than drawing conclusions based on the laws of nature.

The modern approach, based on non-linear dynamics, demonstrates that coincidence is not simply the consequence of a large number of different causes and/or system complexity. It can be the result of system sensitivity to initial conditions. Sensitivity to initial conditions indicates that small causes can have major consequences i.e. that instability is a trait of even the simplest systems. The property of sensitivity to initial conditions is characteristic many biological, demographic, economic and social processes. Systems in which such processes are present very often operate out of balance, with equilibrium constantly changing under the influence of various factors.

For this reason, the approaches to risk management can be:

- the acceptance of risk;
- retroactive risk management;
- interactive risk management and
- planned risk management.

Planned risk management is the starting point in the process of project and risk-based management. The interactive approach has several advantages, but it cannot be used to predict or undertake planned actions to affect all risk. In extreme circumstance, there will be risk events although the planned and interactive approaches have been applied. This points to the fact that there is still a need for retroactive management, which in turn has to be supported by planned and interactive management. The retroactive approach to risk is focused on damage management.

THE UNIQUENESS OF RISK MANAGEMENT SYSTEMS

The analysis of operation of risk management systems points to the number of specificities in comparison to how traditional management systems function. The comparison between the characteristics of the given systems are provided in Table 1, [7].

Table 1: Comparative characteristics of management systems

Traditional Management Systems	**Risk Management Systems**
Constant operating system	Different operating systems
Stable structure and defined function distribution over a longer period of time	Elasticity and the absence of a stable structure and defined function distribution over a longer period of time
Narrow functional direction	Broad and often unpredictable in scope
Monostructural	Multi-structural
Defined information flows	Information flows depend on the current state of affairs
Correct information	Lack of authentic information
Sufficient information	Insufficient information
Low speed of change	High speed of change
Predictability of situations	Unpredictability; relying on previous experience which usually doesn’t make sense
The principle of unity between authorization and responsibility	The principle of distribution of authorization and responsibility
Functional potential	Organizational potential
Socio-economic goals and function criteria are dominant	Goals – eliminate the causes and consequences of risk events efficiently Criteria – minimum time necessary to achieve goals

In order for the risk management system to accomplish its function, it should be designed in order to function in a number of different regimes. The operational regimes of the risk management systems are (Savic, Stankovic, Andjelkovic, [5]:

a) stationary regime
b) high alert regime
c) risk regime
d) post-risk regime

STATIONARY REGIME

The characteristics of the stationary regime are the non-existence of information about the possible incidence of risk event. The primary function of the system in this mode is preventive planning. The focus of preventive planning is to neutralize the causes that can lead to risk events. The tasks of this regime are achieved through:

- monitoring the condition of potentially hazardous constituent parts and environment;
- the preparation and implementation of programs and measures to prevent the incidence of risk events and eliminate the consequences if they arise;
- forecasting the potential development of risk events and their consequences
- providing resources for action in case a risk event occurs and
- creating and applying normative, legislative, economic and expert mechanisms with the aim of minimizing damage.

High Alert Regime

High alert regime is characterized by the existence of information which points to the potential occurrence of a risk event. The essential task of the system in this regime is to elaborate and implement detailed plans for the prevention of a specific risk event based on the previously prepared action scenarios (through a planning program). The development of operational plans and their alignment, harmonization and coordination helps limit the effect of hazard factors, and simultaneously minimizes the consequences of a possible risk event.

This is accomplished through:

- establishing operational groups for the detection of the underlying causes of the emergence of hazard factors and collecting suggestions for their elimination;
- increased monitoring of the status of potentially hazardous elements and environments;
- projections of risk event occurrence probability and its consequences;
- taking measures to protect potentially affected elements and systems;
- implementation and potential operative corrections of the resource utilization plans (material, technical, organizational or financial);
- operational modeling of the occurrence and development of a risk event and the creation of an action plan for the prevention, mitigation and neutralization of potential consequences;
- preparation of the system for operation in the conditions of a pending risk event.

Risk Regime

Risk regime of the risk management system occurs once the risk event takes place. The primary functions of this system are:

- the operational groups for the direct management of actions intended to mitigate and neutralize the consequences of the risk event;
- operational activities with the aim of protecting the elements and/or the system and environment from the effects of unfavorable factors;
- a continual, increased control of the environment conditions and potentially hazardous elements/systems;
- implementing rescue and other necessary activities;
- resources for minimizing and neutralizing consequences;
- organizing the activities of informing the public of the risk event.

The accomplishment of these functions is possible in a management system where **operational** and **strategic** measures have been defined in case a risk event takes place.

Operational (tactical) measures are directed towards the accomplishment of system function in new, more difficult conditions. The purpose of these measures is to ensure the functioning of the management system when a risk event occurs and develops.

Strategic measures involve changes in the structure of a management system in order to prevent the development and consequences of a risk event more efficiently. They include:

- the reorganization of the structure of the management system and the establishment of headquarters with the purpose of eliminating emergency;
- reorganization of the existing or the establishment of a new information system;
- the formation of emergency services: the task of emergency services is to identify the state, create a risk map and research the causes of a risk event;
- forecast of the development of a risk event, modeling the dynamics of development and assessing the resources necessary to neutralize consequences;

- operational development and management, determining priority tasks and responsible individuals, allocation of resources;
- conducting rescue and other urgent tasks (surveying, locating the deceased and injured individuals, emergency medical assistance, fire protection measures, hazardous substances, informing the public etc.).

Post-risk Regime

Post-risk regime is characterized by the absence of active unfavorable factors of the risk event and the implementation of measures that help to reestablish a normal operation of the elements and systems whose functions were undermined by the risk event. The primary function of this system is operational long-term planning of activities whose aim is to mitigate or fully eliminate the consequences of the risk event.

In order for the risk-management system to respond well to unexpected changes in the environment, its structure needs to satisfy the principles of elasticity and adaptability.

The organizational mechanisms in risk-management systems need to be able to recognize new problems, make decisions and implement new solutions, provide resources, unify existing resources and mobilize strengths to neutralize and overcome the consequences of a risk event in the shortest time possible. Within the management system's structure, there are two mutually exclusive principles that need to be implemented:

- individual management (a sense of accountability, responsibility and authorization) and
- distribution of powers and responsibilities.

The managers in the system have personal responsibility for the state of the system. However, simultaneously, they need to coordinate their efforts with various other managers at various levels and, by doing so, contribute to the principle of distribution of responsibilities. As a rule, the strategic risk management responsibilities are taken by a group of senior managers who have the authority and resources to support and implement a rapid operational implementation of the chosen management strategy. Nevertheless, specific operational implementation allows the use of operational measures which are adapted to the development of a specific risk event. It is this possibility of selecting operational measures that are different from the strategic measures for immediate reaction to a specific risk event that makes up the essence of the elasticity principle.

The principle of adaptability is accomplished through the multi-structural organization of the risk management system. Unlike conventional management systems in which the management process takes place through a constant, inalterable structure, risk-management systems are characterized by the potential for structure change in accordance with the current development of a risk event. Multistructurality is typical of the organizational structure of management systems, while the management of existing elements in risk conditions mostly takes place within the boundaries of of conventional structures.

The information on the potential occurrence and trends in the development of a risk event is obtained through monitoring, forecasting and analyzing the state of the environment. This means that at the moment when complete information is available, there is temporal deficiency that impedes decision-making. This leads to the following paradox – by expecting credible and sufficient information, the system suffers loss because of unexpected changes. On the other hand, it is impossible to implement the measures necessary to solve the problem at hand without having sufficient information. However, even when such adequate information is present, its sharing is often delayed in management systems for reasons such as information system inertness, authenticity verification or human psychology.

The diversity and complexity of tasks that arise in the occurrence and development of a risk event and the necessity for their quick resolution demand that the risk management system be broken down into a series of mutually coordinated subsystems. In doing so, it is necessary to ensure that the goals of the larger system are not sacrificed.

It is possible to break down the goal of the risk management system because not all system parameters constitute each and every criterion. In addition, the parameters and the corresponding criteria can first be viewed in general, and then in more detail. The decomposition of the general risk management goal consists of determining the sub-goals and coordination tasks. It is considered final when there is such a decision-making structure in which every local goal (sub-goal) has its own decision-making algorithm and meets the predefined criteria.

In risk management systems, stages of management are typically used as the criterion for decomposing the system into smaller components. This approach corresponds to the highest level of decomposition of the quality management system. System decomposition implies dividing management efforts into risk planning (strategic planning) and risk reduction (operational risk management). The structure of these sub-systems is determined by the goals, criteria and limitations of the system, while the goals of the subsystem are achieved via functions shown in picture 1.

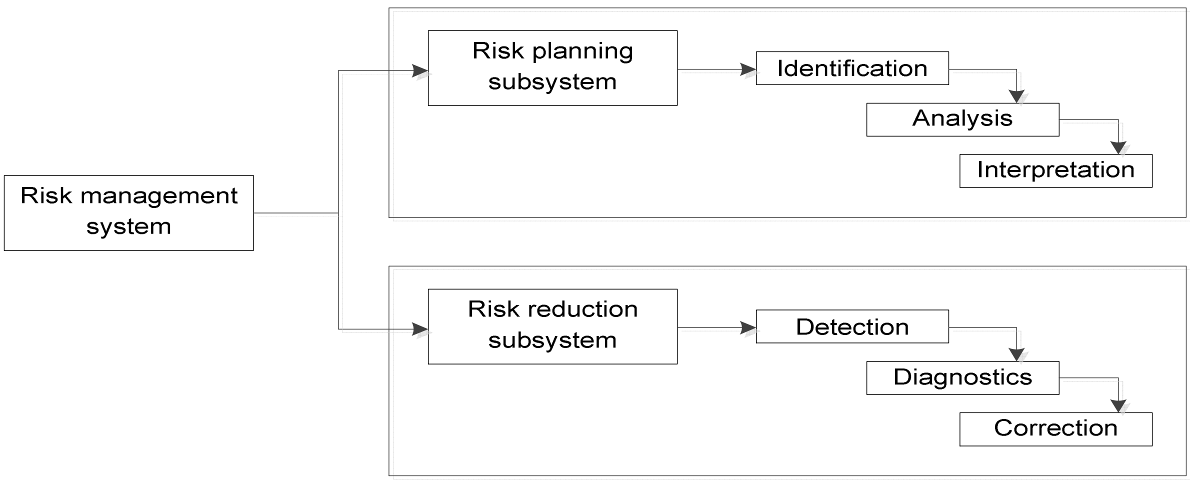
The risk planning program involves the identification and interpretation of potential risk events, as well as the creation of various scenarios of how these events could occur and develop. Risk planning, just like management planning, involves a systemic approach. This involves defining the system of management goals, a set of sub-goals, a set of measures necessary for their accomplishment and quality criteria. It is also necessary to define the limitations that arise in the optimal strategic plan for the accomplishment of the given set of measures.

A system of goals is formed to resemble a tree based on the data collected from the risk event development scenario, which includes: most likely developments of a risk event, development which leads to greatest losses and expected loss assessment. Given the specificities of the risk management system which are analyzed in more detail in this paper, [4], it is necessary to create the following preventive strategic plans:

- the plan to be implemented in the stationary regime of the risk management system;
- the plan to be executed in the high alert regime
- the plan to be used as a starting point in the risk regime.

The plan that is to be implemented in the stationary regime is most commonly created as a long-term plan or program which contains a set of measures and deadlines for task completion and individuals or organizations responsible for their implementation and resources.

Picture 1 - Decomposition of the risk management system



The preventive strategic plan which is to be executed in the high alert regime is created in the stationary regime of the risk management system and contains:

- the plan for changing the operational regime of potentially hazardous items
- the plan for increasing the level of alertness and resources necessary for rescue, relief and other emergency efforts;
- the plan for increasing the level of alertness of material and technical resources.

Based on these plans and information about a potential occurrence and probable development of a specific risk event, operational plans of measures are being created in the high alert regime.

The preventive strategic plan for the risk regime is formed based on basic scenarios of the development of risk events. It contains a set of measures which are supposed to mitigate or prevent the supposed development of a risk event. This plan is a response to a specific risk event and can be subject to operational corrections in accordance with the actual development or the risk event.

The quality of the process of selection, execution and correction of the operational solutions depends on the expertise of the management to adequately utilize the available resources to eliminate the causes and consequences of risk events.

Choosing operational solutions at the moment when a risk event occurs and develops is a creative and responsible task. Its essence is to define the general plan for the amelioration of the risk event, specific measures for executing the plan, the order of action and resources necessary to execute it and provide assistance. The plan needs to be defined in accordance with the pre-defined goals, basic plans and current circumstances. Operational solutions are defined by the manager and he or she has personal responsibility. Operational management solutions should be timely, argumentative, unambiguous and binding. However, several contradictions are present when choosing a particular management solution:

- the complexity of situation assessment and the choice of solutions, as well as the lack of time for the proper choice and execution of managerial decisions;
- increasing specialization for decision-making at the level of operational zones and the need for systemic integration at management level;
- the need to centralize management for task coordination purposes and the need to decentralize management to guarantee stability, operability and leadership initiatives at the level of operational zones;
- how decisions are founded and the operability of management.

The resolution of the abovementioned contradictions is the primary goal of improving the operational management system in risk conditions.

The basic properties of the operational management system quality are: effectiveness, operability and the ability to generate results. Effectiveness is a strategic quality indicator which evaluates the extent of goal achievement. Resultability is an operational indicator which evaluates to what extent the tasks are completed. Operability is the ability of the management system to address management problems in a timely manner and in accordance with system goals and constraints.

INTEGRATED RISK AND QUALITY MANAGEMENT SYSTEMS

Risk management is an approach to management which rests on identifying and controlling the areas and events within system engineering which are the potential causes of unwanted changes within a system. For this reason, risk management is included in all cycles of system engineering. Given the fact that system engineering cycles contain all stages of system life cycle and that failures and crises can occur in each of them, risk management is incorporated in each stage of the system life cycle.

The results of the planned risk management are applied in order to predict problems at the level of planning for each and every cycle. The interactive risk planning approach is implemented in every stage of every cycle. Retroactive risk management is used to point to the results and products which are unacceptable due to low quality. Loss control is implemented in these situations. Loss control is better than no control, although it is better to anticipate potential problems and take appropriate measures to prevent them than react to them only after they occur. This indicates that risk management is one of the key elements of overall quality management.

Quality management implies the achievement of goals in terms of quality, i.e. reducing the risk of quality degradation. The aspects of the system of quality are: product quality, the quality of occupational safety, the quality of environmental protection etc. As partial responses to these aspects of quality, several systems have been created – quality management systems (ISO 9000:2000), environmental management standards (ISO 14000), occupational safety and health systems (ISO 18000), as well as risk management system (ISO 17000). Several relationships can be established among these systems. This can be used as an attempt to integrate them into a larger system but also take into account the unique properties of each individual system [8], [9], [10].

The integrated system management is considered to be a higher level of system organization that has new qualities when compared to certain systems which were integrated in order to create it. The framework for their integration relies on the “quality understood as a pragmatic systemic discipline” as well as risk, which is an inevitable part of all anthropogenic systems.

If risk persists due to inability to achieve favorable effects in terms of risk minimization, it can then be managed through transfer or risk allocation. A classic aspect of this is insurance. After taking a risk, the insurer manages the risk together with the insured [9], [11]. For this reason, it is the purpose of insurance to develop tools, techniques and methods of preventive engineering with the aim of providing an adequate understanding of the problems that the insurer faces by taking the risk.

Risk assessment is just one of the stages of the risk management process. After risk assessment, employers should decide on the risk mitigating or reduction measures i.e. risk management measures.

CONCLUSION

The quality of risk management system depends on several factors – the principles and methods of system decomposition, the segmentation of risk event development, how management functions are organized, the alignment of local goals and the ability to eliminate the consequences of a risk event by using available resources. The collection and allocation of resources is done independently of the possibility and dynamics of a particular risk event development. Consequently, it is the task of the system to implement strategic planning and management and solve pressing operational tasks. The need to develop a long-term strategy in order to prevent and remedy the consequences of a risk event represents an essential new task in management systems and demands new management organization. The occurrence and development of a risk event are often influenced by unforeseeable and unexpected circumstances and cannot be analyzed and solved based on previous experience.

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THE IMPORTANCE OF LEGAL EMPLOYMENT STATUS OF PERSONS INVOLVED IN A PROJECT

Abstract

Human resources represent a significant potential of each organization and each project. Project managers often think that people are their most important resource. For this reason, a successful project requires an adequate human resource planning, formation and development of the project team, as well as project team management. The very nature of the projects often involves project members from different environments and with a wide range of knowledge and skills, therefore, the issue of legal employment status of persons engaged in a project is raised. Since such projects demand temporary work that will exist only for a limited period of time (which does not have to be short-lived), the establishment of permanent employment of the project team members cannot be expected. Nevertheless, a temporary employment relationship is a certain possibility, as well as a wide range of work forms outside employment relationship.

Key words: project, human resource management, legal employment status, employment, work outside employment relationship.

INTRODUCTION

Business activities that are realized in modern living and working conditions are characterized by a high degree of complexity and uncertainty. This fact implies the complexity of the projects themselves and their realization. There is often a large number of people involved in the project, numerous project activities, possible subprojects, etc. This, further, may imply a delay in the implementation of project activities, increased implementation costs, or inefficient implementation of the project as a whole. Also, the business environment is extremely competitive, and customer satisfaction and retention is nowadays more important than ever. For this reason, there is little room for mistakes in projects [1-4]. These open questions are the main motive for reviewing, researching and analyzing the concept of project management.

Nowadays, the best concept describing the efficient work on the project is the concept of project management. This concept is very successfully used to manage the realization of business, military, research and other projects. It represents an exceptional management tool for achieving the project's planned goals, which refer to the realization of the project with required performance in the planned time and with planned costs [1-4]. So today, the concept of project management is widely developed in the world and is especially important in managing projects that are complex and costly.

Project management is a discipline and skill of managing human, material, financial and other resources in order to achieve the assigned goals in the given constraints - deadlines, budget, possibility of realization and satisfaction of all project participants [1-4]. The concept of project management implies the establishment of an efficient organization which enables the best use of available planning and control methods for more efficient project implementation, that is, which enables the most efficient use of available methods, material resources, financial resources and people in the process of project realization. In other words, project management is a scientifically based and practically validated concept that, with the help of appropriate methods of organization, planning, management and control, enables rational coordination of all necessary resources and activities in order to implement the project in the most efficient manner [4].

The main goal of managing the implementation of each project is to ensure the required technical performance and project quality, with the least possible realization time and costs. If it is not possible to achieve the planned time and costs, then the goal is to reduce the time and cost overruns to a minimum. The effects of project management predominantly mean saving time and financial resources, but also rationalizing many other resources (human, for example). These savings and rationalizations depend, above all, on the type of project being realized and the characteristics of the implementation process that is being managed. Although it is traditionally considered that the project has been successfully implemented if its realization meets projected time, planned resources and targeted performances, most commonly expressed by financial criteria, the success of the project is much more than the completion of certain activities at a specific time with the planned funds. The success of the project should be seen and evaluated from several aspects and multi-dimensionally [6].

HUMAN RESOURCE MANAGEMENT IN PROJECT MANAGEMENT

A significant number of project managers believe that people are their most important resource. Effective human resource management on the project is one of the key components of project management because it is not easy to find qualified people and keep them on the project. If any organization wants to successfully implement a project in any area, they have to understand the importance of managing human resources on the project and take measures that will allow for efficient use of the workforce [2].

Human resource management of the project includes processes directed towards the most efficient use of people involved in the project. It involves the management of all project stakeholders - investors, beneficiaries, project team members, support staff, project support providers, etc. In theory, there are four processes in the field of human resource management in the project - human resource planning, creation of a project team, project team development and project team management [2].

Human resource planning for the project involves the identification and documentation of project roles, responsibilities and implementation lines on the project. When designing the organizational structure of the project, it is necessary to identify the personnel needed to work on the project. As the experts engaged in the project are considered the key to its success, special attention must be paid to human resource planning. Also, the basis of human resource planning should be a top-quality project manager and a leader who will be respected by the members of the project team.

When it comes to the project team, after developing a human resource plan, managers shall provide the necessary staff for the project implementation. Creating a project team involves engaging the necessary staff to work on the project. The project should incorporate people who best suit the needs of the organization. Therefore, the project involves employees in the organization, but also other experts if necessary. In this respect, it is important to timely record the needs for staff profiles that will be required for the implementation of the project.

If the project manager has successfully recruited enough people with appropriate skills, it is necessary to ensure that these people work as a team in achieving project goals. The process of developing a project team involves helping people to work together more efficiently and achieve the highest possible result on the project. In that sense, team members often attend specific courses and trainings with the aim of improving personal and team development. Also, a number of organizations carry out training activities for building a team, and noteworthy attention is paid to the award and recognition system as an important tool for fostering team development.

After the development of the project team, the manager conducts project team management during the implementation of various activities on the project. Project team management refers to performance monitoring, motivation of the members of the project team and acceleration of timely feedback in order to improve project results. It is necessary to use different interpersonal skills to find the best way to motivate and manage each member of the project team (e.g. observation, discussion, project impact assessment) [2].

The above-mentioned elements indicate that human resource management requires: the personnel of a particular professional profile, having enough people to perform the envisaged scope of work, replacing someone who, for whatever reason, is not able to participate in the realization of the project, even though he/she is planned, mutual communication required for the achievement of the project objective and training, if necessary [7].

Human resource management needs to envisage one potential problem. Namely, it is possible that one project team member is overburdened with work. This means that this member works in a longer time interval than regular. When the same person is engaged in two or more projects at the same time, or in more activities within the same project, inadequate realization of the expected results may occur [7]. In order to prevent these situations, it is necessary to plan human resources in a quality manner, which would be the first step in human resource management. In that sense, persons who are employed in the organization that implements the project can be engaged in the project, but external experts can be hired as well. Furthermore, it is possible to hire personnel through some form of work outside the employment relationship.

LEGAL EMPLOYMENT STATUS OF PERSONS INVOLVED IN THE PROJECT

Depending on the type of project, a smaller or larger number of people may be involved in its implementation. They may have different legal employment status, because each project has different needs for personnel profiles and their engagement. Certain staff profiles are necessary for the implementation of the project until its completion, while some others are required only for a longer or shorter period of time. In this sense, the project can involve persons in different forms of employment in the organization that realizes the project, but also persons who are not employed in it.

Given the existence of work in the form of employment, but also work agreements outside employment relationships, it is advisable to separately observe these two types of work and place them in different contexts regarding the project. Thus, when it comes to types of employment for carrying out certain tasks on the project, there are several available possibilities – permanent employment, temporary employment, employment relationship for the work outside the premises of the employer, part-time employment, employment for performing high risk jobs, employment with probationary period, trainee employment. Work outside employment relationship can have several forms - service contract, contract of performing temporary and periodical jobs, supplementary work, professional education and training contract.

The project can involve persons who are permanently employed in the organization at work positions that meet the needs of the project realization. There are also classified job positions that, in the job description, include, for example, carrying out administrative tasks related to the realization of project activities pertaining to this organization. This form of work is very suitable for employees as permanent employment implies material and social security for the employee. In this case, the position and length of employment does not depend on the specific project in which the employee is engaged.

Although the establishment of a permanent employment is a form of a working relationship that fully exercises the right to work, it is still very common that persons are only engaged for a limited period of time to perform the tasks as long as there is a need for these tasks. That is, it is possible to establish a temporary employment relationship and this employment will last only during the duration of the project. When the realization of the project ends, the need for the work of these persons ceases. Thereafter the employment is terminated [3]. A temporary employment relationship is a labor law institute that corresponds to the need for hiring a person to work on a project. Projects often require the engagement of some staff profiles only for a limited period of time during the duration of the project, or even for a certain period of project duration. It is then advisable to establish a temporary employment relationship. Persons with temporary contracts have the same rights and obligations as those who work permanently. This also applies to safety and health at work.

In addition to these two dominant types of employee engagement, there are some other forms of employment. For example, working relationships outside the employer's premises, that is work at home and distance work, is an atypical form of employment that is increasingly present in law and practice. This form of work is used to reduce the employer's costs, funds and time to come and leave the workplace, secure greater employee autonomy, etc. [3]. An employee who works outside the employer's premises may be hired to work on the project. In this case, employees working in this way have identical occupational rights and obligations as if they were working in the premises of the employer. This also applies to the right to safe and healthy working conditions.

Part-time employment involves an employment relationship based on a permanent or temporary period of time where the employee works shorter hours than regular. A frequent reason for introducing this type of work is the reduced scope of work which, therefore, does not require full-time engagement. The idea of such work is not frequently practiced at the moment, but there are no obstacles for a person to be engaged in the project in this way. In this case, the person will have the rights in accordance with

their working hours, but the right to safety and health at work is part of the indivisible rights fully enjoyed by part-time employees.
In addition to the above, there are also some types of employment that are not expected to be a common case in the project, but that does not mean that they are not possible.
The employment relationship for carrying out high risk jobs involves working in positions that are difficult, hard and harmful to health although the occupational safety measures are taken [3]. For this reason, only those with particular healthcare capability can work in these positions. Depending on the type of project, this form of work is possible. It is important to keep in mind that the healthcare capability of an employee must be periodically checked and in the event of its loss, the employee will be transferred to other appropriate positions.
The employment with probationary period is aimed at checking the performance and professional capabilities of an employee. It is contracted by the employment contract itself. This check takes place during the employment relationship, with the possibility of terminating the contract after a period of time if the employer determines that the employee does not have adequate skills. This type of employment is also possible when it comes to engaging a person in a project. Furthermore, this possibility is available when engaging trainees in a project with the aim of enabling them to perform the tasks independently.

In addition to these, there are also forms of employee engagement that are not closely related to working on a project. This is the case with, for example, a working relationship with domestic workers. This does not mean that there are formal legal barriers to this form of work, but the nature of this type of employment contract itself is such that it is not expected to commonly encounter the situations in which it will be required.
As for the work outside the employment relationship, it has several possible forms. The service contract, as a common form of this type of employee engagement, is concluded for the performance of activities unrelated to the employer's business. This form of work is also possible when it comes to working on a project since these jobs are not classified by the employer, but at some point there may be a need for their performance. A contract of performing temporary and periodical jobs is concluded in case when there are no special positions for these jobs and they are not performed as permanent and continuous work, but there is an occasional need for their performance. This form of work can be taken into account for project work, but its very nature is such that they are not expected to be a common type of employee engagement in a project. A similar situation is with the contract for supplementary work and contract for professional training and education.

CONCLUSION

In modern business conditions, the complexity and uncertainty of business processes is evident. This implies the complexity of the projects being undertaken, and their realization often involves a large number of persons included in project work and project activities. Human resources are of great importance for a successful realization of project activities. Every organization engaged in project activities has to be aware of the importance of people as a potential for successful project implementation. In fact, human resource management originated as a result of the requirements of the business environment [8]. Human resource management in the project should enable the effective use of people who are involved in the project.
Management of competences and behavior of people in the work process enables efficient realization of project goals. In that sense, it should be born in mind that people, as a resource on the project, in many different ways affect the success of project activities. People can achieve outstanding business results if they are well motivated and their work has a long-term impact on the organization itself since the effects of certain decisions can, for years to come, reflect on its operations [5].
All the above reasons emphasize the work forms of people participating in the project. In one organization, persons can work in the form of an employment relationship or in some form of work outside the employment relationship. Thus, the organization can employ persons for a permanent period of time and their job description shall involve some activities related to project work. This form of work is most acceptable to workers because it provides material and social security. A common form of work is a temporary employment relationship. This form is also possible for project work. Moreover, some legislations (e.g. in the Republic of Serbia) perceive the work on the project as a form of employment for a limited period of time. In addition to the aforementioned, a project can involve persons working

under a contract for performing high-risk jobs, under a distance contract, with a trainee, etc. These forms of work are legally possible for performing project activities, but the extent to which they will be employed in the organization largely depends on the type and nature of the project in question.
In addition to working in the form of an employment relationship, the project can engage persons through a contract that involves the work outside employment relationship. Thus, there is a service contract, which is a common form of work in organizations. In addition to that, there is a contract of performing temporary and periodical jobs, contract for supplementary work, and the like. The project itself and project activities determine the very nature of the contracts.

Based on all of the above, it can be concluded that the organization implementing the project has a wide range of forms of employee engagement. The organization has the ability to determine the form of employment contract based on its needs at a given moment. Some forms of work are a logical choice for a project, such as a temporary employment relationship. Also, there are some forms of work which are not common for a project, such as an employment relationship with domestic workers, though there are no legal obstacles to their introduction. Also, some of the above forms correspond to the interests of the engaged persons differently (for example, permanent employment is still a preference for employees). This leads to the conclusion that, when choosing the form of engaging a person in project implementation, the interests of the organization should be taken into account, but also the rights and interests of the persons engaged in the project.

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