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PROJECT MANAGEMENT

CHALLENGES OF IT PROJECT PORTFOLIO SELECTION*

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Abstract: *This paper presents possible challenges in the process of IT project portfolio selection. The paper begins with explanation IT project portfolio management. IT project portfolio management needs to ensure that the group of IT projects support achievement of the goals of the corporate strategy. The paper considers key aspects of IT selection process and introduces organizational support for IT project portfolio selection. An established PMO that is actively supported at the executive level can help solve problems with project selection and initiative approval.*

Key words: *project management, project portfolio management, project selection, IT project, portfolio management office*

1. INTRODUCTION

The task of the IT project portfolio management is to ensure a consistent approach to the classification, selection, prioritization and planning of the right IT projects and programmes in the company (Reyck, Grushka-Cockayne, Lockett, Calderini, Moura, & Sloper, 2005). The aims of IT project portfolio management are as follows:

- optimization of IT project portfolio results (not an individual project or portfolio);
- harmonization of IT projects and programmes with the company's strategy;
- selection of IT projects and programmes to be realized;
- defining IT projects and programmes priorities;
- discontinuing or stopping IT projects or programmes;
- coordination of internal and external resources for IT projects and programmes; and
- organizational learning between IT projects and programmes.

2. IT PROJECT PORTFOLIO MANAGEMENT

An efficient realisation of an IT project is said to be a key factor of the company's business success. This is, however, only partly true. The achieved competitive advantage is not the result of efficient work on a project only. The fact that companies conduct real IT projects is important. IT project portfolio management is meant to ensure a successful execution of the company's strategy through the most effective and most efficient execution of respective IT projects possible (Verhoef, 2002). It is closely related to the role of the top management in the company and with the key decision makers in creating the environment in which set goals can be achieved.

According to Cooper, Edgett and Kleinschmidt (1997), works dealing with the issues of project portfolio have appeared since 1970. In these works, elements such as "selection of research-developmental projects", "resource allocation in research-developmental projects", "project prioritization"and "portfolio management" are analysed.

The majority of works on this topic deal with the problem of portfolio management by defining the optimization methods and techniques (Cooper, Edgett, & Kleinschmidt, 1998). According to these works, the portfolio management problem appears to be a limited optimization in the conditions of uncertainty: multiproject and multilevel model of decision making should be achieved by means of mathematical programming. The starting models for the selection of projects were mathematically oriented and they used techniques such as linear, dynamic and full number programming. The aim was to develop a portfolio of new and existing projects to maximize some function goals (e.g., the expected profit) as the issue of setting resource limitation.

The application of these methods immediately revealed some difficulties in solving the problems of IT portfolio management (Verhoef, 2002). Contrary to the many methods developed in an early stage of the

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approach to this problem, none of these could be adequately implemented in the IT project portfolio management.

The IT projects are recognized as a vital fact for any company. The influence of the IT projects upon the future of any company is certainly strong since they are related to all the important events and processes in the company, be it the development of a new product, the implementation of a new service process, the change in organizational structure or the launching of a new business (Russell, 2003). The IT project portfolio is a collection of projects which together with other projects make the strategy of the company's investments.

The project portfolio management means the implementation of knowledge, skills, methods and techniques upon a set of projects in order that the needs and expectations of the company's investment should be attained and even exceeded (Dye & Pennypacker, 1999). This calls for a balance to be made between strategic and tactical requirements. The IT project portfolio management usually requires that a definition should be made of what is possible and what is necessary. Balancing between the possibilities and the needs generally results in finding the best possible solution within limited resources.

There is a gap today between a majority of management models and the environment in which the IT projects are executed. These models emerged in the circumstances in which it was possible to predict the consequences of certain decisions and the project's impact upon the company and the community in general. A successful IT project portfolio in the project environment nowadays is characterised by a number of non-economic features, uses an iterative budgeting process and what appears to be the best decision for an organization may not be viewed as such for all its stakeholders. Today's the IT project environment is much more complex compared to a majority of management models, and such a complexity must be taken into account in defining „the best" IT project portfolio to be executed.

The IT project portfolio management focuses upon a clear definition of the values the projects bring to the company (Kaplan, 2001). The IT project portfolio management is applied to all projects, to making decisions as regards the selection and prioritization, which is in accord with the strategic goals and the development of the company.

Alongside decision making on the IT projects execution within a portfolio, there is another process of the final approval of the very beginning and of some specific phases in the IT project execution underway. There certainly must exist a lower level of decision making that takes place in the real time of the IT project execution. Decisions within the IT portfolio are made during the given time intervals, all the projects being discussed together, whereas at a lower level decisions are made on individual IT projects at any moment the project passes from one execution phase into another. All this may cause conflicts between the two levels of decision making, since in decision making processes we most frequently deal with different people, even different criteria.

Decision making at the portfolio level, although taking all the IT projects together and making a comparison among them, does not pay enough attention to individual projects (Levine, 1999). On the other hand, the lower level of decision making focuses upon only one IT project, leaving out all the other IT projects. It is of great importance for the company that these two different decision making processes be integrated and harmonized. The dominance of either of the two is unwelcome in any company.

The weakness of the IT portfolio model appears to be insufficient accuracy or relevance of the facts on the basis of which the processing, the analysis, and the conclusion procedures are conveyed and then a final decision is made. The models used in IT portfolio decision making are by far more advanced compared to the input data. Financial indicators, criteria and the processing and presentation methods themselves may be well created and functional for making the final decision. However, all these calculations and use of the seemingly appropriate criteria may lead to a wrong decision, if the data used are incorrect, inaccurate or unreliable (Morris, 1997). If we wish to enhance the success of an IT portfolio decision making process, we must ensure that we have as high a quality of input data.

In their research Cooper, Edgett and Kleinschmidt (1997) have found that the main problems the companies encounter in the project selection and portfolio management are the following:

1. The project portfolio does not reflect the strategy of the company;
2. The portfolio quality is poor;
3. The checking procedures and the decision making procedures at check points are inefficient;
4. Scarce resources and lack of focus;
5. Simplification of the product development projects.

The issue raised in the companies that apply the project-oriented organization concept is whether the undergoing IT projects should be discontinued or deprioritized in favour of certain better quality projects that we become acquainted with. On one hand, we should try to keep the resources engaged in IT projects flexible and capable of shifting from one project to another, as the need may be. The reason for such an attitude is found in the need that the company's management be granted an opportunity to allocate resources in a best possible way, regardless of their current use. On the other hand, there are attitudes that the resources involved should remain in the project all along, regardless of whether there is a more attractive project in sight. Here the issues of continuity and the morale of the project team and the project manager appear to be considerably more important than an optimal allocation of resources. Such a view resulted from the attitude that discontinuing and restarting the project would mean a substantial loss of resources and time, that a shift from one project to another would by all means affect the projects and that a launch and discontinuation or a final suspension of a project would all need additional time and costs (Wysocki, 2004).

The new IT projects always appear better than those under way, therefore the resources in the projects that are in the final phases are usually transferred as a support to new projects. Such support sometimes results in the projects deprived of resources in this way being never completed (Thomas, 1993). The far-reaching consequences and damages for the company fail to be perceived in that moment.

There is no universal rule on how we should act or set the company policy in such cases (Norton & Kaplan, 2003). It is certain that the long-term IT projects call for a continuity in order that satisfactory results should be obtained. On the other hand, there is a need that the company responds to changes in the market by introducing a flexible model of resources distribution. Many companies find that using only financial methods and criteria in giving priorities to IT projects prove inappropriate. The reasons most frequently lie in the financial simplification, which results into an unreliable image of the project, especially prior to the launching of the project, when the prioritizing is most necessary, but also, during the execution of the project. Analyses carried out upon executions of projects have shown that the evaluations of key parameters on the bases of which decisions are made were significantly incorrect.

Statistical implications of the portfolio choice are complex and varied. They include the analysis of both internal and external factors of the company, the company's market position, the strengths and weaknesses of the company. These analyses may be used to create a wide perspective of strategic directions as well as specific initiatives for achieving competitive advantage (Cleland, 1999). Such a procedure may be used in developing focused goals of the IT project portfolio and determining the necessary resources for its support. In estimating the strategic position of the company a portfolio matrix is used, where the different criteria for the company positioning are presented in one or more graphs within two description dimensions. A decision maker may use such a presentation to estimate the current position as well as the position the company wishes to occupy in the future. It is clear that the company's strategic direction must be defined prior to the analysis of the individual projects for the IT project portfolio. Successful organizations conduct a broad strategy preparation and planning before individual projects are analysed.

Upon determining the strategic direction, it is necessary that IT projects be selected and resources allocated. The IT projects selection includes the identification of opportunities, the estimate of organizational fitting, the cost analysis, the cost and risk analysis, the forming and the selection of the portfolio. The success of the IT project portfolio depends on the readiness and the support of the company's management (Verhoef, 2002). This is more important, sometimes even crucial, than just the selection of the method to be used in project selection.

A periodical review of IT project portfolio is absolutely necessary (Bridges, 1999). This means that each active project should be checked, those on the waiting list as well, and should be compared to another. The aim of this check is to find out whether there is the right set of active projects and whether these projects are still in accord with the strategic goals of the company.

To aid the decision making process it is necessary that general criteria are established, as well as the evaluation of each IT project related to those criteria. Since a majority of decisions are based on multiple factors, it is necessary to evaluate each criterion in order to establish a relative importance of each of them. Thus we could identify what is most important for the company, and every project could be measured as regards the criteria that are defined as important (George et al., 2005).

The company must establish an unbiased mechanism of monitoring and control of IT projects (Reyck, Grushka-Cockayne, Lockett, Calderini, Moura, & Sloper, 2005). Measuring may be based on the revenue from the project in relation to the resources invested; then there is measuring of a number of projects within the project portfolio and a continual adjustment to the overall goals of the company. It is very important that there exists an agreement from the start on the process of authority determination. Only when the company

defines its overall goals and the investment strategy into the IT projects, will it be able to create an optimal group of projects or an IT project mix to implement its strategy and achieve goals.

In order to achieve a respective relation between the risk and the extent of revenue from the investment into IT projects, it is necessary that each project be evaluated on the basis of its two characteristics: technical difficulties and added value. The secret of a successful IT project management is in understanding critical relations between the probability of success and the values the project will earn if successful. This provides a good basis for quality decision making on the input portfolio of IT projects.

A majority of portfolio decisions is aggravated by a long time horizon, high level of uncertainty and a large number of variables affecting each project (Ghasemzadeh & Archer, 1999). The tools most commonly used in developing a business model that would predict a potential project value are a learning diagram, a sensitivity analysis and a decision tree.

The purpose of the decisions related to the IT project portfolio is not only the selection of right projects; it is also the inclusion and strengthening of appropriate personalities and their groups who are to realize these decisions efficiently and effectively. Creating an adequate level of participation between cross-functional teams allows for a constructive dialogue between decision makers and those who are in charge of enacting them, which leads to coordination of ultimate actions to be conducted (Englund, Graham, & Dinsmore, 2003).

The portfolio analyses and deals with the future events and possibilities where the majority of information necessary in the selection of projects is at best uncertain, and at worst is largely unreliable. The decision making environment is dynamic, and the status and the perspective of the IT projects in a portfolio constantly change in accordance with the inflow of new information and technologies. The IT projects in a portfolio are in different phases of execution and compete for available resources. However, the comparison among the IT projects is made with varied quantities and reliability of information. The resources distributed among the projects are limited, which is to say that the decision on resource allocation to one project means depriving another project of resources, and the transfer of resources from one project to another usually leaves deep scars.

3. SELECTION OF IT PROJECT PORTFOLIO

The selection of IT project portfolio is one of the crucial steps in the portfolio management process. It is a periodical activity of choosing one portfolio among the available project propositions and projects which are underway, and which achieve the defined organizational goals in a desired way, without exceeding the resources available or breaking other limitations (Archer & Ghasemzadeh, 1996). IT projects selecting directly guides and adjusts business activities to the strategic guidelines of the company. It is within this process that decisions are made on the future execution of IT projects as well as on any vital aspects of their realization.

By undertaking a proactive approach to the IT project selection and real performance management the companies significantly enhance the achievement of IT project goals as regards time, quality and costs, as well as making sure that these projects will facilitate the overall business success. Using quality principles in decision making on evaluation and management of IT project portfolio profitability and productivity may be significantly improved. The IT projects, however, include factors that account for the complexity in the process of project portfolio harmonization. One of the most important among them is the interaction of the projects within the portfolio (Mantel & Meredith, 1999). IT projects are not independent, they overlap and are related to each other by depending critically on each other, in different ways.

Although there are numerous methodologies to be used in selecting an IT portfolio, so far the consensus on which one is most effective has not been reached (Reyck, Grushka-Cockayne, Lockett, Calderini, Moura, & Sloper, 2005). As a consequence, every company tends to choose a methodology that corresponds to the existing organizational culture and allows for the analysis of project attributes it considers the most essential.

The conventional methods of measuring IT values, the estimation of what is easily measurable – costs – and the expectation that an automatic cost saving or cost avoiding practice will pay the investment off do not, in fact, represent the real value IT earns to the company. The problem is reflected in the IT professionals' inability to establish a link to the business value of the proposed IT solution which consequently fail to get the manager's support until it is too late. The problem of inadequate communication is often largely based on the fact that IT managers do not have an effective access to the data they need in order to approach the benefits of a certain IT initiative.

Numerous IT managers estimate IT investments solely on the basis of IT costs saving. While this approach is valid in case the critical factors of success are directed towards reducing exploitation costs in time, it may prove problematic when it is necessary to take into consideration the overall value created by an innovative application of information technologies in business (Sommer, 1999).

As a consequence, the strategic role of investments in new IT initiatives that may lead towards new business opportunities for an organization is neither recognized nor measured. One of the key problems in the total cost scenario implementation is the lack of communication between business activities and technology management, when decision making on implementing new information technologies and the resulting specific business benefits are concerned.

Without the knowledge of where and how IT earns value for the organization, it is impossible to measure this value in concrete quantitative terms. Also, without financial guidelines in defining the value of increased business flexibility, it is difficult to develop a meaningful proposition of values to invest in any IT initiative.

In preparing the input data for the portfolio selection it is necessary to analyse whether the project is worth the risk undertaken (Cooper, Edgett, & Kleinschmidt, 1998). This means conducting an overall identification of potential risks, risk estimation, the analysis on the impact the risk may have on the project, a discussion on the moves to reduce risk and estimation as to whether the project is still justified after the risk reduction costs are added.

The input information for portfolio selection is to allow for (Levine, 1999):

- finding out which of the projects proposed bears the greatest value for the company, so that the priorities in resource allocation may be defined.
- an estimation of the projects proposed in view of their importance for the overall portfolio, especially as regards the availability of resources and the realization of other projects.
- identifying projects which lag behind the planned terms by 25 percent or more and analysing influences upon the entire portfolio in case these projects are discontinued (depending on the availability of resources and the realization of other projects).

The choice of the method to be used in the project estimate depends on the purpose of the project. The most frequently used methods of project estimate of individual IT projects are the following:

- economic revenue – net current value, internal profit-making rate, return on capital, pay off terms, expected value
- benefit-cost techniques – include the calculation of the benefit-cost ratio, where the inputs represent the total value of all benefits and costs
- risk analysis – a combination of the probability of events (usually undesired events) and consequences related to the event. Every project carries a certain risk of failure to reach the desired goals
- potential project success – specific measuring of the probability of project success
- degree of acquaintance with the organizational strategy
- degree of acquaintance with the activities of competition
- degree of acquaintance with the organizational financial goals.

Individual projects may be estimated as good, however, they may be negative from the point of view of the company (Kerzner, 2003). Therefore it is essential that the project be analysed not only from the aspect of its success, but from the aspect of its contribution to the overall goal of the company as well. The project must not endanger the existing benefits and advantages the company has. No decision on the project requires all the analyses possible, nor is every element equally important.

Strategic decisions affecting the IT portfolio focus should be executed in a broad context that takes into account both external and internal business factors, and before the project portfolio is selected. The frame of the project selection should be flexible enough to allow for prior selecting of individual techniques and methodologies that are adequate for the relevant data analysis and decision making on the selection in a certain type of projects (Markowitz, 1991).

The project portfolio selection and adjustment is an iterative process (Meta Group, 2002). The existing projects require resources from the set available therefore the time of execution and resources are interdependent and affect new projects. It is a general practice that the review of the estimate of the project key elements is conducted at the end of each phase, in order to determine whether the project is eligible to be continued.

As regards the plan and the input information we have when we enter the decision making and the project execution processes, further execution may change many things. The best project may prove to be only average, and sometimes it is necessary to discontinue the project since it does not promise satisfactory results (Ghasemzadeh & Archer, 1999). During the execution stage it is therefore necessary that requireded adjustments be made, in accordance with the changes that appeared in the process.

The current IT projects that reached a certain key event should be reviewed again at the same time when new projects are analysed to be selected into the IT project portfolio. Thus it is possible to, in accordance with the resources available, generate a combined portfolio in regular intervals, and this is defined by:

- project completion or project abandoning
- new project proposition
- changes in strategic focus
- review of available resources
- changes in the environment

Problems related to the project failure and project discontinuation may be reduced if those working on the project approval are better organized and more careful in the decision making process. Within the IT project portfolio the scopes of performances for each project must be identified. It is necessary that certain acceptable values that would serve as an alarm tool within the IT project portfolio management system should be defined in advance.

4. PORTFOLIO MANAGEMENT OFFICE AS ORGANIZATIONAL SUPPORT FOR IT PORTFOLIO PROJECT SELECTION

Companies usually have a large number of different projects within their portfolio and the more these differ, the more complex their management process becomes (Englund, Graham, & Dinsmore, 2003). In order that a successful execution of an individual IT project be supported and its compliance with the goals of other projects and with the overall organizational strategy be ensured, there must exist a specific integrative structure, e.g., strategic centre, expert group, centre for competence in project management or a portfolio office (Block & Frame, 2001; Bolles, 2002; Dinsmore, 1993; Miranda, 2003). Some of these may be virtual organizational units (Gareis & Huemann, 2000; Seltzer, 1999).

The hierarchically highest level is the Portfolio Management Office. The Portfolio Management Office defines projects and programmes in accordance to the general organizational strategy and goals. Its basic role is managerial and is related to the project portfolio management process phases, from defining the portfolio and categories of projects (such as IT projects) to the control and periodical review of the existing priorities and plans. The Office can also be viewed as the director or managing board headquarters, with an impact upon the strategy and a general direction of the company's development. Though primarily engaged in the activities on the strategic management level, it works together with the members of the Project Management Office on the operational jobs related to coordination of project activities, developing and spreading the project management principles throughout the company in certain situations (changes in plans, radically changed business conditions, delay caused by lack of resources, etc.).

The strategic role of the PMO is primarily concerned with the project portfolio development and management and its coordination with the organizational strategic goals. Hence the PMO provides the basis for a quantitative estimate of the portfolio management success in the organization and promotes the awareness of the portfolio management value.

The PMO provides numerous benefits for the organization that implements it, in view of the portfolio management process standardization, project execution improvement, professionalism building, improvement of organizational performances, etc. However, the other part of the PMO implementation has negative aspects that diminish the importance of the benefits listed above. Its significant weaknesses are: implementation costs, stress and conflicts, dualism in decision making, lack of clearly defined responsibilities, delays in execution, etc.

In a large number of organizations the implementation of the PMO remains, unfortunately, at the operational level, therefore the support of modern PM concepts in strategic planning and management is minimized. The management of such an organization will have to make additional efforts towards restructuring, changing the business methods and improving the PM competence level in their employees in order to position the PMO on a strategic level, that is, on project management as a basic competence of the company. Only in this way will the advantages of corporate project management be fully visible.

5. CONCLUSION

Modern companies rely on their IT to a large extent and this cannot be denied. It is almost impossible nowadays or in future to imagine a successful business without an equally successful IT. On the other hand, the link among these structures is often not strong enough so as to make this relation useful for new investments and joint projects. In order to understand why some organizations earn greater financial value from implementing the same information technologies compared to some others, numerous research have been conducted. Among the best practices certainly is the joint vision of valuable opportunities that exist both in the IT and in business units, quality business planning for any initiative and an effective linking of projects and programmes. The basis of all these is the portfolio management with its process of work.

In the project-oriented organization, strategic management is implemented by way of project portfolio management. Classification, selection, prioritization, planning, monitoring and control of programmes and projects are defined and analysed as basic elements of project management. The IT project portfolio management is to allow for a consistent approach to classification, selection, prioritization, planning and execution of the right IT projects and programmes in the company. The IT project portfolio management is characterised by uncertainty as well as by changing information, dynamic possibilities, manifold goals, strategic analyses, interdependence of projects, manifold decision making and group decision making. Defining and managing the IT portfolio is today one of the most demanding processes in modern business.

The development and selection of the IT project portfolio is a process which helps optimize a set of IT projects, not just one project. The approaches in IT portfolio development vary from simple ranking, based on a cost reduction rate, to very complex methodologies that take into consideration the interrelations among the projects. Organizations tend to select a methodology appropriate to their organizational identity and allowing for the analysis of project attributes they consider the most essential. Regardless of the model chosen, the goals should be related to the portfolio optimization, not only the optimization of individual projects. The choice of IT project portfolio mostly depends on the company's strategic direction, its capabilities, limitations and the complexity of the project.

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ORGANIZATIONAL PROJECT MANAGEMENT MATURITY ANALYSIS OF ENERGY SECTOR COMPANIES

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Abstract: *This paper discusses the current situation in project management in the energy sector in Serbia, by analyzing the results of the project management maturity research. The research was conducted on a relevant sample of project managers and members of project teams implementing energy projects in more than 70 organizations in Serbia. Firstly, the paper presents an overview of the generic project maturity model, followed by the presentation of data on current and projected situation in energy sector in Serbia, with the aim of understanding the context of the research. Secondly, it moves on to presenting the results of research and the analysis of results obtained. Finally, the paper offers recommendations for improvement of specific aspects of project maturity, as an answer to the challenges that the Serbian energy sector is likely to face in the years and decades to come.*

Keywords*: energy sector companies, projects, project management maturity*

1. INTRODUCTION

At the beginning of the second decade of the twenty-first century, Serbia has been facing numerous problems in the energy sector. Great dependence on import of oil and natural gas, which constitute as much as 17.4% of the total national import volume (Statistical office of the Republic of Serbia, 2013), obsolete electrical and energy capacities, low energy efficiency in almost all sectors (Oka et al.), represent only several among many problems affecting the country's development. As an attempt to solve some of these problems, Serbia has adopted The Energy Sector Development Strategy of the Republic of Serbia by 2015 (MMERS, 2005). The Strategy lists the following five energy policy priority programs in the forthcoming period (MMERS, 2005):

- Priority of continuous technological modernization of the existing energy facilities/systems/sources in the following sectors: oil, natural gas, coal including strip mining and underground mining, power sector, production facilities – thermal power plants and hydro power plants, distribution systems, thermal energy sector – district heating companies and industrial power plants.
- Priority of economical use of quality energy products and increase in energy efficiency in production, distribution and utilization of energy by end consumers of energy services.
- Priority of use of new renewable energy sources and new, more energy efficient and environmentally acceptable energy technologies and installations/equipment for energy utilization.
- Priority for extraordinary/urgent investments in new power sources with new gas technologies (combined gas-steam thermal energy installations).
- Priority of constructing new energy infrastructure facilities and electric and thermal power sources within the energy sectors of Serbia, as well as capital-intensive infrastructure, within the frameworks of regional pan-European infrastructure systems connected with Serbian systems.

Aiming to implement the priority programs and encourage the development of energy sector, the strategy has envisioned investments of up to EUR 8 billion between 2008 and 2015 (MMERS, 2005). Given the overall workload anticipated over the mentioned period, the emerging imperative is the need to establish an efficient system of project management in energy sector.

2. PROJECT MANAGEMENT MATURITY ANALYSIS OF ENERGY PROJECTS

Maturity models can be implemented in almost all processes in an organization, including quality management maturity, energy management maturity, human resource management maturity, overall organizational maturity model, etc. Recognizing the significance of project management in achieving organizational strategic goals, it was to be expected that the organizations would develop the need for

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assessing the project management maturity (Cooke-Davis and Arzymanov, 2003). The key reasons for the growing interest and significance of these models underline the fact that many organizations implementing project management principles were unable to measure the success of implementation, or to compare their own practices with those of other organizations. Additionally, these models enable the identification of phases critical to the process of advancing of project management practices and achieving higher performance levels (Mihic, 2010). Maturity models identify strengths and weaknesses of the organizations and provide data used for benchmarking (Judgev and Thomas, 2002).

Project maturity can be viewed as a capacity of an organization to successfully implement its projects and programs. Analysis of the project maturity allows for evaluation of achievement of strategic goals through implementation of project management principles. The research conducted by Loader (2006), indicates the existence of a strong link between organizational project maturity and the success of the projects it implements. Organizations at a higher project maturity level are also more successful in implementation of their projects, whereas those at lower project maturity levels often encounter problems such as failing to achieve project objectives, exceeding deadlines and budget, underachieve client requirements, etc.

Analysis of some of the best known project maturity models, such as CMM, PMMM, OPM3, PRINCE2, EFQM, IPMA project excellence award model, etc, helps define a generic project maturity model consisting of five levels: initial, repeatable, managed, distributed and continual improvement level (Mihic, 2010). The level of project maturity can be determined by means of standardized questionnaires containing key elements of project maturity in an organization (Crawford, 2006). The elements of project maturity have been derived from knowledge areas defined by Project Management Institute (PMI, 1996).

The energy sectors of most countries are facing numerous challenges, most of which represent the results of multi-decade global orientation towards fossil fuels as the main generators of economic growth. Such orientation is contrary to the sustainable development principles, which, in relatively close future, can lead to serious environmental, economic, social and political consequences on a global level (UN, 1987). In addition, the accelerated economic growth of certain countries or regions contributes to an increase in the overall energy consumption worldwide (Zhang and Wang, 2011). Therefore, projects in the field of energy tend to focus more on the development of energy efficiency, construction of facilities for producing energy from renewable sources and electrification in developing countries.

Several general characteristics of the projects in this area can be identified in accordance with the established practices of implementation of energy projects and Flyvbjerg and Flyvbjerg's research (2004). The characteristics are as follows:

- Energy projects are classified as capital investment projects and often require substantial financial investments.
- Inherent to these projects are numerous risks that come as a result of the inability to forecast all threats in the process of long-term planning.
- Implementation of these projects is complex and often includes hundreds (or thousands) of activities.
- Implementation of these projects does not employ standardized technology.
- Decision making and planning involves a number of stakeholders who may have conflicting interests at times.
- Workload may significantly differ at times.
- Project budgets are often set without contingency reserves for funds and time, which leads to exceeding budget or time boundaries, often resulting in exceeding the deadlines and costs or in underachieving of forecasted benefits in the majority of projects.

Organizations in energy sector operate in a very dynamic environment with significant risk exposure; in addition, these risks have escalated since the beginning of the global downturn. The mentioned environment, being prone to frequent fluctuations, affects the regular operations of energy companies, and also influences project management in this field. Nevertheless, the problems such as delayed implementation or exceeded budgets are not exclusive characteristics of energy projects; rather, they are a reflection of project management shortcomings connected with an organization's deficient project maturity. Improving project maturity may result in improved project success.

3. OVERVIEW OF THE EMPIRICAL RESERCH

Empirical research of the project maturity in the energy sector in Serbia was conducted in 2013 on a sample of 75 respondents from 75 organizations. The respondents were expected to answer a questionnaire built around key aspects of project maturity. Five questions were defined for each of the aspects. The

questionnaire also featured questions important for appreciation of the strategic aspect of project management analysis. To ensure the collection of high-quality data important for understanding and verifying the obtained results, focus groups and interviews included key management personnel from selected organizations. The data was processed using the software package SPSS ver.16.0.

Data about a broad span of characteristics of organizations and projects that were researched, speak in favor of relevance of the questionnaire. The research encompassed some of the largest and most prominent organizations from the Serbian energy sector, as well as smaller organizations that provide goods and services to the energy companies. The average number of participants in projects covered by this research was 84.61; falling within the interval ranging from 5 to 240. The average duration of the projects was 19.98 months, with the duration ranging between 2 and 90 months. Average project budget was EUR 7.452.367, i.e. ranging between EUR 30.000 to EUR 55 million. The research included 10 program managers/directors, 27 project managers and 38 members of project teams. The majority of projects in organizations covered by this research were implemented in Serbia, whereas only a few were executed abroad (in ex-Yugoslav states). Based on the data about the characteristics of the sample, it can be concluded that the research presented herein is consistent with the trends in the area of project management in the energy sector in Serbia and can, therefore, be taken as a foundation for assessing the actual state of matters in project management in the organizations observed, as well as for the formulation of recommendations for further improvement. Furthermore, it is useful to point out that there are no statistically relevant dependencies between the success of the implementation and the number of people hired for the projects, the duration of project implementation and project budgets. Therefore, the sample constitutes an adequate basis for further research of project maturity in the Serbian energy sector.

The principles of examination of project maturity in individual organizations were used as a starting point for analysis of project maturity in Serbian energy sector. Inclusion of the majority of energy companies in Serbia in this research facilitated the identification of common characteristics of project management practices in this sector nationwide.

The research presented herein was envisaged so as to incorporate all questions and elements of project maturity most pertinent to the successful implementation of this type of projects, not necessarily adhering to the format of any of the existing project maturity models mentioned in the second chapter. The research of the project maturity in energy sector, presented in this paper, is the first of this kind in Serbia. The results obtained in this research, as well as the recommendations for further improvement, may largely contribute to the more efficient implementation of energy projects.

Analysis of the results obtained should be complemented with the results of the statistical testing relating to the existence of statistically relevant dependencies between certain categories in the research conducted and statistical differences in maturity between strategic and operational levels of management of observed projects.

According to Andersen and Jessen (2003), the concept of maturity indicates that there might be a development from one level of capability to a higher one. One of the goals of this research is to establish whether there is a statistically important difference in maturity between managing the project as a whole and managing individual activities within it. For this purpose, we have compared 2 groups of answers relating to the questions that directly correspond to different levels of project management: the level of project/program and the level of activities. The value of paired t-test equals 4.143, with statistical relevance at 0, which means that there is statistically important difference in project maturity on the level of project/program on one side and project activities on the other. In addition, according to statistical data, we can conclude that energy projects in Serbia are better managed on the level of entire program/project than on the level of individual activities.

4. ANALYSIS OF RESEARCH RESULTS AND DISCUSSION

Analysis of gathered results relating to various aspects of project maturity and individual questions has shed the light on some of the obvious problems in the area of managing energy projects in Serbia. Some of these problems are as follows:

- Project management office is not adequately developed;
- IT systems are not sufficiently used;
- Poor risk management;
- Poor planning, particularly in the segment concerning the use of methods, techniques and mechanisms for monitoring project implementation;

- Poor results in the area of planning and implementation of benefits, etc.

Furthermore, certain positive examples of project maturity can be identified in individual elements or questions, such as:

- Clearly defined responsibilities and roles of project managers an project staff;
- Relatively efficient financial management;
- Largely successful identification and alignment of benefits;
- Relatively sound communications management, etc.

The results relating to project maturity elements or questions should not be observed independently from other elements or questions. Discerning correlations between different processes of project management provides for appropriate examination of the project maturity and enables us to determine the true nature of any deficiencies, and implement the appropriate improvement measures accordingly.

The results relating to the existence of well-defined responsibilities of project managers and project staff can be considered satisfactory. Given that the clearly defined roles and responsibilities of project management and staff are one of the prerequisites for successful project communication, it is understandable that positive results in this segment reflect positively on solid results in communications management. However, fairly low results were recorded in the segments concerning the existence of project management office (42.7% positive answers and as much as 32% negative answers). The main functions of project management office (PMO) are: risk management; communications management; use of software tools in project management, and stakeholder management (Mihic, 2010). Also the PMO plays an important role in project monitoring and coordination. Despite the fact that relatively good results were achieved in some segments of communications management and monitoring of project costs, underdeveloped PMO largely contributed to the poor research results in the area of risk management, IT support and stakeholder management. Absence of a fully functioning PMO or its partial existence in many organizations has a profoundly adverse effect on the existence of efficient mechanisms for project monitoring and coordination among projects/activities with the purpose of transferring surplus resources to those projects or activities that need them. The conclusion is that energy companies in Serbia need to establish PMOs as functional units that would strive to efficiently contribute to the implementation of the organizational strategy. The manager of PMO would have complete responsibility for achieving the project goals of an organization. Based on the results of dependency analysis, it is possible to conclude that the PMO is particularly essential in organizations involved in the implementation of multiple projects involving a vast number of participants, long duration and a sizable budget.

Analysis of planning of the projects/programs points to certain discrepancies between the processes of planning and implementation of projects/programs. Namely, the results of monitoring of the course of projects are in collision with the results relating to resource allocation planning and establishing efficient mechanisms for monitoring project implementation. Given that energy projects often imply considerable funding, and that, as a result of long duration, frequent changes take place in the course of implementation, it is important to monitor the course of the project on a regular basis. Consequently, it is understandable that over 90% of the organizations partially or fully monitor the use of resources and changes in cost structure. However, in order for the monitoring to be efficient, it is important to clearly define and implement a system for monitoring the course of project. This system should largely be supported by information technologies, i.e. appropriate software solutions. Poor results in these segments are the result of an inadequate structure and level of development of the PMO, as mentioned earlier in this paper. Fairly low implementation of project planning methods and techniques (such as WBS diagrams, milestones, schedule analysis, etc.) are rather easy to identify in the segment of planning of projects/programs. The use of these methods largely contributes to the success of project implementation as it forms the basis for risk analysis, assessing the duration of the project, its budget, number of participants in the project, etc. Taking all of the above into account, the conclusion is that the organizations operating in the energy sector in Serbia are in need of efficient mechanisms for measuring project progress indicators. These systems should be supported by appropriate software solutions and should be implemented both on the level of individual activities and on the level of programs. Likewise, there is a need for consistent use of methods and techniques of project planning, which, in turn, can contribute to the improvement of other elements of project maturity and improve projects' success rate. This finding was confirmed by analysis of dependencies.

Results of research relating to the identification and alignment of all benefits that the project/program should produce can be regarded as positive (68% positive answers, and only 6.7% negative answers). However, other aspects of benefits management show serious deficiencies, primarily in areas of planning, monitoring and securing the benefits. More often than not energy projects produce direct benefits that are fairly easily identifiable. They mainly consist in improving the energy balance of the country or region, growth of employment in the energy sector, securing procurements for energy industry, increased certainty of energy

supply to consumers, etc. (Mihic et al. 2011, 2012a, 2012b). However, poor results relating to planning, monitoring and securing the benefits, primarily stem from the complexity of this type of projects (several hundreds or thousands of activities, long implementation periods, unforeseen events…) and identified deficiencies in use of project planning methods and techniques. Analysis of dependencies has proven that efficient benefits management is critical for the success of any project.

Risk management is of the weakest aspects of project maturity. It has already been pointed out that energy projects often encounter problems such as exceeding deadlines and budgets. The root cause of these lies in the project/program planning phase. The planning phase in energy projects is often affected by varied stakeholder interests in terms of time or cost constraints. The budget is often set according to estimated costs, and it often does not include contingency reserves. The situation is similar in the case of overall project duration. Since the budget and the timeframe are preset, the need for thorough risk analysis seems to disappear. This analysis would, however, cover a detailed identification of risks, assessing the likelihood of their occurrence, and defining the procedures for risk avoidance, reduction or addressing the consequences. This is the reason why risk analysis is taken somewhat more seriously on the level of entire project/program, whereas on the level of activities only key risks and the likelihood of their occurrence, reduction procedures and response plans are identified.

In terms of the strategic aspect of project management in Serbian energy sector, the gathered results indicate the need for improvement of the implementation of strategic management in observed organizations. To be precise, 61.3% of managers in the surveyed organizations have recognized the need for strategic management and 72% of the organizations have a strategic plan in place. This in itself is a positive result. However these results are inconsistent with the much less positive results of the examination of well-defined phases in strategic management and the existence of the department for planning and (strategic) analysis. Likewise, positive results were recorded in relation to the examination of central coordination of resources in an organization (62.7% positive answers), but these were also inconsistent with the identified deficiencies of project management office, efficient coordination of multiple projects and the existence of professional mechanisms for project monitoring. The results obtained lead to the conclusion that Serbian energy sector is in need of further strengthening of the links between strategic and project management, in order for the strategic goals of an organization, as well as of the entire country, to be achieved. The links between an organization and project management should be strengthened trough the development of strategic plans specifying the roles and responsibilities of both the functional units and the PMO in the attainment of an organization's strategic goals during the course of project implementation.

Having in mind the previously described characteristics of project maturity in Serbian energy sector, it is necessary to define measures aimed at removing deficiencies in project management and at encouraging a faster development of the energy sector. The proposed measures are presented in Table 1.

Table 1: Summary of recommendations for improving project management maturity in Serbian energy sector

Area	Recommendations
General	• A more detailed project planning and management, most of all on the level of individual activities; • Education of project managers relating to the implementation of project management methods and techniques, as well as to the use of relevant software tools.
Program/project management	• Establishing of PMO in organizations implementing a numerous large-scale projects; • Establishing efficient mechanisms for monitoring project progress; • A more intensive implementation of project planning methods and techniques supported by adequate software tools; • Establishing an efficient system for coordinating parts of a project.
Benefits from the program/project	• Definition of plans and responsibilities relating to project benefits.
Risk and quality management	• Definition of risk management procedures on the level of project phases and activities within a project. • Establishing a special service in charge of project quality management; • Certification of quality management system; • Definition and consistent implementation of quality plans in all projects.
IT support	• Implementation of project management software and adequate training of project staff.

5. CONCLUSION

The research of project management maturity in the energy sector was conducted in Serbia in 2013. It featured a questionnaire divided into nine areas of project maturity. The research has shown that organizations in this industry are not fully prepared for numerous, dynamic, large-scale changes expected in the forthcoming period. Energy projects, their complexity and inherent risks, as well as the fast-paced changes characterizing the contemporary market and world in general, impose an obligatory improvement of nearly all project management processes in organizations. An integrated analysis of results from the entire questionnaire confirmed that managers lack proper training for leading energy projects, stressing the need to implement extensive measures aimed at professional and specialized trainings. An analysis relying on the elements of project maturity detected several critical points relating to project management in Serbian energy sector. Key areas that, according to the results, require immediate improvements are: establishing of a functional PMO; utilization of risk management tools; use of software solutions for planning and monitoring project implementation; improved communication with stakeholders, etc. The statistical analysis of gathered answers confirmed that an adequate implementation of project management methods and techniques is necessary in projects requiring substantial investments, involving long duration and numerous staff, because it contributes to a higher success rate of projects. In addition, a statistical analysis confirmed that project management teams focus more on projects than on individual activities within them. This also stresses the need for a more intensive implementation of project management methods and techniques in energy projects implemented in Serbia.

Energy sector in Serbia faces considerable challenges. Investments expected in this area over the years to come can potentially generate immense benefits to the society. Nevertheless, in order for these benefits to be generated, it is important to manage the projects in this area efficiently. Application of the project management maturity model facilitates assessment of the current capacities of Serbian organizations to successfully implement energy projects, and offers a set of recommendations aimed at improving project management processes. Only a consistent implementation of project management concepts in the energy sector will lead to the achievement of strategic goals of, not only the energy companies, but also the Republic of Serbia, as defined in the national development strategies.

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EMOTIONAL INTELLIGENCE: NEW COMPETENCE OF PROJECT MANAGERS

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Abstract: *Emotional intelligence is not a new concept. However it is not applied to modern management in an adequate manner. This paper tries to examine whether this personal characteristic is needed competence for successful project manager. For this purpose, substantial theory review was conducted and two surveys were analyzed. Results show that there is correlation between success of project managers and their competence. Also it is clearly shown that project managers do need to have emotional intelligence in order to run successful projects and move forward in their careers.*

Keywords*: emotional, intelligence, competence, project, manager*

„Emotional intelligence, more than any other factor,
more than intelligence, or expertise, counts 85% to 90% success on the job...
Intelligence is the limit.
You need but it, but it cannot make you a star.
Emotional intelligence can.“
Warren Bennis

1. INTRODUCTION

Project managers should understand that the people involved in it represent a heart and a soul of every single project - their relationships, skills and ability to function as a compact entity. Skilled project managers from the first day of the project focus their attention on the understanding of human dynamics and predict possible human interaction along the project. Human Dynamics is based on researches originated back from 1979, which involved more than 40,000 people from 25 different cultures. They identify and document the inherent differences in the functioning of the people as a part of a system. Generally, team dynamic is defined as a motivating and driving force that "pushes" the team members towards achieving their goal or mission. It is a social process in which people interact and behave in accordance with environment of the group they belong to.

The starting point for the use of emotional intelligence is when you realize that project management refers to the work with other people. Project manager's success depends on the other people involved in the project. In order to achieve what was important, it is necessary to work at the team level. Big and important projects generally require big and effective project team, as well as an effective project manager. Efficient project teams do not just happen, they are carefully prepared by a group of highly qualified (in terms of skills and abilities) and motivated individuals who have a clear picture of their own goals and receive a clear and tangible evidence of their accomplishments.

People do not realize the importance of emotions in general, and today especially they do not understand their key role in the doing business. In terms of project management, emotional intelligence can be crucial to the success of the project. It is essential that the project manager becomes aware of his own feelings, learn to trust them and accept them as a source of information. If he or she properly recognize and regulate its own emotions and the emotions of the team members, this will be helpful in carrying out the project activities, resolving potential problematic issues, becoming a better leader and will create a "dream team", which will be, thanks to the good atmosphere and the energy, more productive and achieve a better performance.

2. EMOTIONAL INTELLIGENCE

Intelligence comes from the Latin word *inteligere*, which means understand, comprehend. Many definitions do not currently define it as mental function. Certain authors state that intelligence is the ability to solve new problems and cope with new situations, and some believe that it includes the capacity for abstract thought,

understanding the causes and consequences of a problem, the ability to distinguish important from unimportant, ability to learn and to adapt to a given goal. Other authors focus on intelligence as the ability of small and rapid learning and acquiring new skills.

David Wechsler defines intelligence as a global concept of an individual to act with intention, think rationally and effectively deal with its environment (Wechsler, 1958).

Numerous studies of intelligence, lead to the conclusion that intelligence has its own categories, and this model is called model of multiple intelligences defined for the first time by Howard Gardner (Gardner , 1983). He named the six categories of intelligence that involves the abstract (symbiotic reasoning, mathematics and formal logic), social (understanding the social context and addressing the people), practical (common sense), emotional (awareness and managing own emotions), aesthetic (sense of form, design, music, art and literature), and kinesthetic intelligence (skills of the whole body including sports, dance, music). After him, Sternberg gave a little clearer and more accepted image of intelligence by defining its aspects, so-called aspects of successfulness. The concept of multiple intelligences (MI model) is based on the idea that human beings are equipped with the whole range of mental abilities, not just IQ and is now widely accepted in business and in education. MI model radically changes the view of intelligence as a genetic predisposition, an innate ability that never changes and makes it clear that the "intelligence" is capabilities that can be learned and developed. Intelligence is now divided into seven intelligences as follows:

- Analytical Intelligence - refers to the resolution of problems which means that clearly defined problem has only one solution;
- Creative intelligence - a new situation creates new ideas;
- Practical intelligence - involves the lack of clear, common situations with multiple solutions;
- Social intelligence - is successful navigation the complex social situations;
- Emotional intelligence - observation, expression, understanding and regulation of emotions;
- Moral Intelligence - involves understanding and judgment, righteousness;
- Existential intelligence - raises questions about the meaning, life, and death.

Project Management Institute has published research on the intelligence in the project environment. The research shows that intelligence is a factor of success in almost all projects, and has an incredibly large impact on the achievement of project objectives. The project team, led by project manager must possess the competence of not only cognitive intelligence, but also many other competencies that are based on the individual capability as well as the ability to establish positive relationships between all members of the project team. PMI lists the following types of intelligence in the project:

- Professional Intelligence - the ability to master and control the knowledge, information and skills within a given project professional environment;
- Rational intelligence - the ability to solve logical problems in the project environment;
- Physical Intelligence - the ability to learn and master the physical skills;
- Creative intelligence - the ability to produce new and original ideas;
- Emotional intelligence - a productive personal interaction of team members (self-confidence, self-control, self-motivation and empathy);
- Social intelligence - the ability to accomplish complex social skills such as teamwork, communication, conflict resolution, harmony, achievement of consensus, multiculturalism; and
- Leadership Intelligence - the ability to express leadership skills such as leadership, motivation, negotiation, influence and control.

Recent research after 90s have confirmed that there is an emotional brain - a place called the limbic system, where our emotions reside. This place is separate from the rational part of the brain (the neocortex), but they are certainly linked and developed together. This means that our power of reasoning and our feelings are intended to be used together. Because of the design of the brain, all the information go first to our emotional center, and then in the center of our thinking. Emotions come before thoughts and behavior. What scientists have confirmed is that we badly need our emotions, our feelings which "turn on the engines" that produce energy and creativity. As a result of these studies, it has become important to understand what we feel, what other people feel, how to manage our own emotions and how to manage relationships with other people. This is the essence of emotional intelligence - terms used to describe the complexity of regulating our impulses, connecting with other people, and resilience in the face of difficulties. Because of this, emotional intelligence is the product of a number of information exchanges between the rational and the emotional center of the brain (Mackin, 2006).

Among researchers there is a lot of indecisions when it comes to emotions. While most agree in their basic set, their opinions differ when it comes to less well-known emotions. One of the most common definitions of emotions explains that emotions are a mental condition that often arises spontaneously rather than through

conscious effort and are often accompanied by physiological changes, feelings - feelings of joy, sadness, respect, love and hate (The American Heritage Dictionary of the English Language, 2006).

Founders of emotional intelligence are two psychologists Peter Salovey and John D. Mayer who, with their definition of emotional intelligence pushed psychological concept forward, who received the most attention in the academic and practical literature ever since (Salovey & Mayer, 1990). According to them, emotional intelligence is the "ability of monitoring our own emotions and feelings, and emotions and feelings of others, the ability to create discrimination among them and the use of this information for the management of our own thoughts and actions."

Their model includes and identifies five main areas: understanding own and other people's emotions, managing emotions, self-motivation, recognizing emotions in others, and relationship management. After Salovey and Mayer's research, interest in emotional intelligence has begun to grow significantly, and many authors have begun to explore this concept. Each of them gave their own "stamp" to emotional intelligence, by changing certain competencies it covers, but basically, it all finally came down to research Salovey and Mayer's. It is a great pity that the two of them did not called the concept of emotional intelligence using something that is characteristic for them, say "SaloMayer principle" because in future studies this term was used as a global term.

In 1995, Daniel Goleman wrote the book "Emotional Intelligence - why it can matter more than IQ?", which rapidly became a bestseller. After that, he wrote more books on this subject, linking emotional intelligence with a successful business and this book became synonymous for this concept. His definition, perhaps the most general of all, states: "The ability to recognize our own and others' emotions, self-motivation and managing emotions in ourselves and our relationships with other people. (Goleman, Emotional Intelligence: Why It Can Matter More Than IQ, 1995)"

Goleman adapted by Salovey and Mayer's model as a basis for its discussion on the theory of emotional intelligence and its impact on life, including the business world. He adapted the model of emotional intelligence to develop four emotional competences and this is one of the most accepted and most widely used approach in the development of emotional intelligence in humans. He lists the following competencies:

1. Self-awareness. High emotional intelligence is associated with high self-awareness, which means recognizing and interpretation of emotional signals in ourselves and others, and the impact of emotions on the other. Once a person becomes aware of its own thoughts and feelings, he or she can use them as positive thoughts and feelings - the instructions. A high level of self-awareness leads to self-confidence, realistic self-assessment and a sense of humor. He stated that the skills associated with self-awareness include:
    - Emotional self-awareness – recognition of our own emotions and their effects (recognition of emotions, connecting feelings with actions, words and thoughts, understanding the impact of emotions on performance, possessing leading awareness of personal values and goals).
    - Accurate self-assessment - knowledge of our own strengths and limitations (awareness of personal strengths and weaknesses, ability to learn from experience, open to sincere feedback, new perspectives and personal development, the ability of showing a sense of humor and own perspectives).
    - Self-confidence - honest belief in ourselves (the ability to have the confidence and "presence", demonstration of views that are different and/or unpopular, determination and decisions making despite uncertainty).
2. Self-management. The ability to use awareness of our own emotions in order to provide flexibility and direct and positive behavior. Self-management is a strategy to change our own mood, a tendency not to judge other people and to think before acting. Emotions affect the personal performance, and the performance of the other. Emotions are contagious. People with self-management skills tend to show integrity and reliability, are open to change and are comfortable with ambiguity. Self-management skills help people to overcome the perspective of "victims" and reframe stressful situations into a challenge, in addition to becoming more than feasible. Knowing and managing our own "emotional triggers" is critical for self-management. It includes the following components:
    - Self-control - managing disruptive emotions and impulses (managing impulsive feelings and stressful emotions, staying calm and positive even in difficult times, thinking clearly and stay focused under pressure).
    - Trust - maintaining standards of honesty and integrity (to act ethically and above complaint even in the face of conflicting emotions, to build trust through reliability and authenticity, admit mistakes and deal with the actions of others).

- Conscientiousness - taking responsibility for personal performance (to learn about the obligations and keep promises, to be responsibility to the goals).
- Adaptability - flexibility in managing change (smoothly managing various demands, changing priorities and rapid introduction of change, flexibility of views on situations and events).

3. Social consciousness. Once a person becomes aware of his own emotions honestly and with the intention of understanding them, it's time to look around itself. Emotional intelligence is reflected in the inclusion of our own feelings and the feelings of people around us. A key component of social consciousness is empathy, which is basically the ability to see the world from another's perspective. It begins by listening. Individuals who do not have the skills of empathy are more focused on their own needs and problems and do not pay attention to anyone else. They do not build positive relationships with others. Social awareness involves the development of positive and effective relationships with people in the environment and the ability to communicate in order to prevent conflict, achieve higher consciousness and light distribution of the basic tension that can accumulate and have a negative impact on work relations. These relationships encourage cooperation and teamwork. Research shows that people when they get to know the other person, within 3-5 seconds determine whether they like him or her and if he or she can be trusted. This is how much it takes for the emotional part of the brain to form a first impression. The rational part of the brain does not have time to engage, and it deliver an intellectual proof later on. Components of social consciousness are as follows :
   - Empathy - feeling other people's emotions and perspectives and demonstrating an active interest in other people's problems and concerns (paying attention to the emotional signs and good listening, showing sensitivity and understanding of others' perspectives, providing assistance on the basis of understanding of others' needs and feelings).
   - Orientation - predicting, identifying and meeting the people needs (answering to their needs, finding ways to increase satisfaction and loyalty of others, offering appropriate assistance).
   - Political awareness - identifying current and potential emotional relationship of the group (accurately identifying key relationships, detecting crucial social networks, understanding the forces that shape the attitudes, views and actions, "reading" the situation accurately).

4. Relationship management. Relationship management involves mastering the skills of self-awareness, self-management and social awareness that paves the way for more effective relationships. It refers to the interaction with people and skills in managing others' emotions. Relationship management includes:
   - Impact - the use of effective negotiation tactics (skillful persuasion, the use of complex strategies like indirect influence to obtain consensus and support, management of dramatic events to effectively highlight some key points).
   - Communication - sending clear and convincing messages (efficiency of sending and receiving emotional signals, openly dealing with difficult issues, good listening, mutual understanding and full exchange of information, fostering open communication and humility in accepting the bad news).
   - Conflict management - negotiation and resolving misunderstandings (dealing with difficult people and tense situations diplomatically and tactfully, identifying potential conflicts, disagreements and bringing them to light, encouraging debate and open discussion, providing win-win solutions.
   - Collaboration and cooperation - functioning with the others towards common goals (directing focus on duties with special emphasis on relationships, free sharing plans, information and resources to promote friendly, cooperative climate, nurturing the opportunities for collaboration).

Matthews, Zeidner and Roberts (Matthews, 2007) published their research and make a distinction between two concepts of emotional intelligence - the capabilities model of emotional intelligence and attributes model of emotional intelligence.

The first model explains emotional intelligence as the ability similar to cognitive abilities and measure it through tests based on performance. It is seen as another legitimate form of intelligence. This model is also known as emotional cognitive capabilities or emotionally intelligent information processing. This model uses Salovey-Mayer's definition and explains that emotional intelligence is divided into four branches. The first relates to the emotional identification, perception and expression – it deals with the ability of accurate perception of emotions in verbal and nonverbal behavior of others. The second one relates to the emotional relief - the ability to use emotions to assist thinking and problem solving. Third, emotional understanding is the ability to analyze feelings, discrimination of emotions and thinking about the results. Finally, emotion management deals with the possibilities of reflection and change of feelings.

The second model, a model of emotional intelligence attributes, perceive it in relation to personality and self-reporting. In this model, emotional intelligence is defined as a set of cognitive skills, competencies and skills that influence one's ability to successfully struggle with the demands and pressures of the environment.

This model uses the broadest definition of emotional intelligence. Capabilities such as perception of emotions are usually combined with non-cognitive competencies, abilities and personality attributes. This model measures the five wide factors and fifteen aspects, namely:

- Intrapersonal - emotional self-awareness, self-confidence, independence, own meaning and self-actualization;
- Interpersonal - empathy, social responsibility, and interpersonal relationships;
- Stress management - stress tolerance and impulse control;
- Adaptability - reality testing, flexibility and problem solving;
- General mood - optimism and happiness.

There are conceptual and methodological issues related to research of emotional intelligence with this mixed model, mainly due to the ambiguous definition and very broad content of the model.

Hendrie Weisinger said: "People are born with the ability to regulate emotions, like a thermostat, but rather to nurture skills, most people walk around them, like mercury in a thermometer, only as a response to what is visible around them. (Weisinger, 2000)" He believes that whenever people blame someone else for the way they feel or behave, they gave up control over their emotions and behavior and handed control to the people around them. Also, according to managers, leaders or people with a high coefficient of emotional intelligence understand that people need to be valued and appreciated, that they need a sense of belonging, a real future, a future full of hope, and the basic organization of their lives.

Bruce Cryer and Lew Childre added to the above Goleman's definition that emotional intelligence improves through the internal quality management (Bruce & Lew , 2004). They say that it is about a genuine increase in the internal coherence and balance in person, and that there is not any doubt that emotional conditions of people affected by the brain and its ability to process information.

We can conclude that all the research on emotional intelligence and its definition can be reduced to four, what we can call - components:

- Self-awareness,
- Social awareness,
- Relationship management and
- Managing emotions.

These components can be viewed through two dimensions related to social and personal skills. Personal competencies include self-awareness and self-management, i.e. own emotions, and the social skills relate to social awareness and relationship management.

3. PROJECT MANAGERS AND EMOTIONAL INTELLIGENCE

If you take a look at list of the competences successful project manager should have, even though there are numerous competences, most of the authors dot mention emotional intelligence as a necessary one. Having that in mind we have conducted several researches trying to establish whether that is important or not.

One of the researches was focused on identification of correlation between project managers' emotional intelligence and educational and business success. A sample of 75 project managers had to show are there any correlation between emotional intelligence and success. One of the standardized test was used. Results show (Figure 1.) that Project managers on top management level have an average EI of 4.33, on executive management level 4.09, on middle management level 3.68 and on operational management level 3.71 (Obradović, Jovanović, Petrović, Mihić, & Mitrović, 2013).

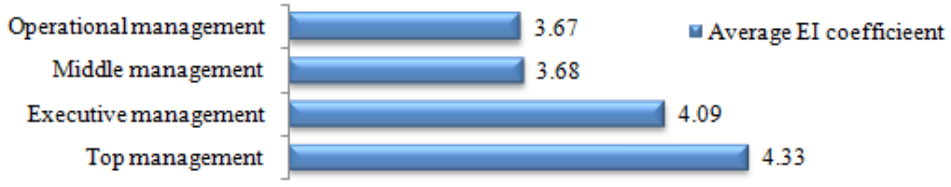

Figure 1. Coefficient of EI in relation with position in organizational hierarchy

Another research conducted had slightly different focus. It aimed to all managers in the organization, not only project managers and to establish is there any correlation with type of manager and emotional intelligence. Results show that highest level of emotional intelligence have middle managers which are actually project managers since the survey was conducted in a project based organization.

Table 1. Emotional intelligence levels on various managerial positions

Managerial level	Average emotional intelligence
Operational management	3.90
Middle management	4.25
Executive management	4.06
Top management	4.19

One can see that results show different results in these two researches, implying that there are differences in emotional intelligence among various managerial levels, but also among different types of managers.

4. CONCLUSION

We came to the conclusion that emotional intelligence is defined by mixed set of capabilities that allow a person to manage themselves and others. This definition can be more accurate if it is accompanied with frequency with which an individual shows itself or use constituent skills or competencies inherent to emotional intelligence that determines the way in which certain persons deals with itself, life and, other people. Decades of research of the effects of psychotherapy, cognitive behavioral therapy, training and education programs have shown that people can change their behavior, mood and self-image (Goleman, 2001).

The current conceptualization of emotional intelligence raises a challenging question: Can a person change their capabilities in a set of competencies that makes emotional intelligence, and that has been proven to bring great results in many occupations, including project management? Series of studies conducted on this topic, confirm that people can change in relation to the competencies of emotional intelligence, usually within two to five years (Weatherhead School of Management (WSOM) of Case Western Reserve University).

Daniel Goleman states that there are three reasons why a person may wish to develop their emotional intelligence. The first is to increase the effectiveness of the work or to increase of the potential for improvement. The reason could be called career development objective or professional development. Another reason is that a certain person wants to become a better person, which is connected with the goal of personal development. Third, people may want to help other people to develop emotional intelligence. All these reasons lead to the simple conclusion that people definitely need to work on their personal development in terms of emotional intelligence competencies, and a starting point for this development and self-change is actually finding out who we really are and who we want to become.

Exploring this theme we have proved that an improvement in emotional intelligence assist project managers in developing their careers and the impact of this concept on the success of the project manager is really great.

Anhtony Mersin states that while working with project managers he realized that they really understand the emotional intelligence at a concept level (Mersin, 2006). The challenge for them is that they lack the tools to use this concept in project management. Ultimately, how you use emotional intelligence in project management?

In life, it is clear that the smartest people are not always those who are the most successful and most fulfilled. There are people who have excellent academic background, but who are socially unsuccessful in work or in their personal relationships. Emotional intelligence affects the following:

- Success on work
- Physical health
- Mental health
- Connections and relationships with other people

All information come into our brain through our senses, and when the information is too stressful or emotional, instinct can take over the ability of behavior. In order to have access to a wide choice and the ability to make good decisions, primarily we need to be able to balance the emotions that arise. It is clear that in order to enhance emotional intelligence primarily we need to understand and learn to manage our own

emotions. This can be achieved by developing key skills for the control and management of overwhelming stress and effective communication. Each skill is build on the lessons learned from the past and by practicing following (Segal & Smith, 2014):

1. Quick reduce of stress at different times;
2. Recognizing own emotions and keeping away from indulging them;
3. Emotional bonding with other people through the use of non-verbal communication;
4. Using healthy humor and a connections in challenging situations;
5. Resolving conflicts in a positive manner and with trust.

By emphasizing the importance of emotional intelligence for project management, as well as in relation to the above-mentioned quote, we conclude that the impact of emotional intelligence on the performance of project managers is extremely high. Emotional intelligence of the project manager can make a different and much needed "star" in every modern organization.

Open expression of thoughts, feelings, and intentions allows people to really see each other for what they are and encourages confidence and building of positive social relationships. These managers are freed from prejudice and very clear and real in observing current relationships and situations. Knowing yourself and having the ability of making good choices when it comes to relationships, fosters a climate in which even the most diverse and difficult issues can be discussed. Self-conscious project manager is at all times ready to undertake concrete actions and absolutely sure about decisions he or she made, displaying at the same time a clear opinion on issues related to the implementation of projects.

What are the possibilities of a project manager who has a strong sense of empathy? People believe that others are really interested in their feelings, intentions, problems and deepest hopes. The project manager must take the time for the members of his team in order to understand exactly what they feel and think. This kind of relationship creates authentic and close relationships between people and assist managers to cooperate with people from their project team much easier.

What are the possibilities of achieving the objectives of the projects being run by a project manager who has the perspective to see the needs and interests of all members of the team? Such manager, even in difficult and dangerous situations reflect careful and firm presence. It is clear that people with this brilliant ability to influence other people are respected and valued for their vision and the possibility of transforming people through building relationships of trust. The possibilities are simply immeasurable.

Emotional intelligence coefficient of various managerial levels are different. It turned out that mid-level managers that are project managers have an extremely high coefficient of emotional intelligence, and therefore a greater awareness of this concept. We certainly believe that in the short time they will become very successful senior level project managers who will be able to manage the most complex projects in a very simple way.

Since this is a concept that will become more and more popular in a future, a concept necessary for any job interview, and certainly for a daily life, it is important to begin a general rise of awareness about emotional intelligence and its competences. For the new generation, a work on this concept will be required in early childhood, and emotional intelligence will be introduced in the education system. We hope that the importance of self-awareness, social awareness, emotions and relationships management will be fully recognized.

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HOW TO SELECT THE BEST PROJECT MANAGER?

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Abstract: *This paper proposes a method for ranking candidates according their past performance and their qualitative personal qualifications for managing a project. The rank allows selecting the best candidate to be the project manager. The method also allows evaluation of the past performance of project managers. The proposed method combines between two common methodologies: the Data Envelopment Analysis (DEA), the Analytical Hierarchical Process (AHP) and ranking methods via DEA. The method is especially useful for the assignment of project manager for an important project.*

Keywords*: Project Management (PM), Analytical Hierarchical Process (AHP), Data Envelopment Analysis (DEA), Ranking Methods (RM).*

1. INTRODUCTION

Experts for organizations and human resources managers are constantly busy in searching ways to examine the performance of workers and managers. The evaluation of past performance of the employees can be made according to quantitative and/or quality parameters. The evaluation allows to establish a comparison between the workers and to rank them according to their performance. The rank allows selecting the best candidate for a specific job. This paper proposes a method to rank candidates for managing a project. The method also allows evaluation of the past performance of project managers.

A project success is depended on several critical success factors. One important factor is a competent project manager with proven leadership skills (Fortune & White, 2006). In the selection of the project manager his/her past performance should be considered and his/her personal and professional skills. If there are several candidates for managing an important project, it is a common practice to select the best candidate on the basis of several criteria. Some of the criteria are qualitative/subjective (for example, leadership, technical skills and teamwork ability) and others are quantitative/objective related to previous projects (for example, completion time, completion cost and meeting the technical requirements). In order to evaluate the past performance of candidates to be the selected project manager their completed projects should be examined. Many criteria can be used to compare the relative performance success of completed projects. Asosheh et al. (2010) discussed about 30 criteria reviewed in six papers they surveyed concerning IT project management.

The project manager selection process has been widely discussed in the literature. Hadad et al. (2013) surveyed several papers of this topic, here some of them in brief. Zavadskas et al. (2008) proposed a set of criteria for the selection of construction managers. El-Sabaa (2001) conducted a survey concerning the skills of successful project managers. Hauschildt et al. (2000) identified five types of project managers. They calculated the prevalence of each type and examined the success levels of project managers classified to each type. Muller & Turner (2007) claimed that project managers' past performance depends on their competence, particularly their leadership. It can be concluded that the criteria most often taken into consideration are the candidate's personal skills, project management skills, and experience in similar projects. Cheng et al. (2005) concluded that task competencies are specific to a given project. However, when selecting a project manager one must consider both: the past performances of the candidates as well as their suitability for the specific project. Eilat et al. (2006) stated that project performance evaluation is a multiple-criteria problem. The criteria and their weights must be determined and weighted according to the organization's preferences.

In order for project managers to successfully and effectively perform all of their functions, they must be experienced, knowledgeable and skilled - in other words, they must possess competence, and personal competence is proven through certification (Uhlir, 2013). Of course, a certificate cannot guarantee an individual's success, but Uhlir (2013) claimed that a certification is a significant indicator and tool for differentiation between project managers. In this paper we propose we assume that there is a group of certified project managers. The aim is to rank the managers according their past success and according to their qualitative personal criteria and then to select one of them for managing a specific project.

This paper is expansion of the decision-making support system (DMSS) which proposed by Hadad et al. (2013). The DMSS of Hadad et al. (2013) used only objective criteria in order to rank a group of candidates. This paper proposes to use the scores that each project obtains by the previous DMSS as input to a revised

DMSS, and with other qualitative/subjective criteria to obtain a full rank of the candidates. The revised DMSS combines two well-known methodologies: Data Envelopment Analysis (DEA) (Charnes et al., 1978) and the Analytical Hierarchical Process (AHP) (Saaty, 1980). Moreover, the DMSS uses ranking method in the contest of the DEA (see, Adler et al. 2002, Hadad & Hanani, 2011). Combining AHP with DEA can be found for example in: Sinuany-Stern et al. (2000); Hadad & Hanani (2011); Hadad et al. (2013); Yang & Kuo (2003) and others.

2. LITERATURE REVIEW

This section introduces the two well-known methodologies that are at the basis of the proposed model, the Data Envelopment Analysis (DEA) and the Analytical Hierarchical Process (AHP). The DEA evaluates the relative efficiency of Decision-Making Units (DMUs) and the AHP converts qualitative evaluations into quantitative criteria. Furthermore, this section introduces ranking methods in the DEA context that can be used to rank the project managers.

2.1 DATA ENVELOPMENT ANALYSIS (DEA)

The DEA (CCR model) was first developed by Charnes et al. (1978). The DEA is a non-parametric method to evaluate the relative efficiency of DMUs based on multiple inputs and multiple outputs, even if the production function was unknown. The DEA provides a mechanism for measuring a DMU efficiency (in our case project), compared with other DMUs. The DEA methodology solves a linear programing (LP) formulation per DMU and the weights assigned to each linear aggregation are the results of the corresponding LP (Adler et al., 2002). The DEA has become a useful tool for operations researchers (Emrouznejad, et al., 2008 report on over 4000 references on DEA; see also Tavares, 2002 and Seiford, 1996), its use by economists is limited (5%). There are also many papers that use the DEA for comparing project efficiency (for example, Vitner et al., 2006; Eilat et al., 2006; Mahmood et al., 1996, Hadad et al, ,2013, Hadad & Keren, 2013).
The DEA finds different weights for each DMU, such that any DMU in the objective function with the optimal weights will receive a maximal efficiency score. In the DEA, the weights of the inputs and outputs vary from DMU to DMU. Moreover, DEA can distinguish only between efficient and inefficient DMUs (dichotomic classification). Therefore all the efficient units have the same ordering score and it is difficult to rank according to the DEA score. The DEA measures the relative efficiency score as a ratio between the weighted output and the weighted input. DEA calculates for each DMU *k* the ideal weights for each output- U_r^k $\left(r=1,2,..,s\right)$ and the ideal weights for each input-V_i^k $\left(i=1,2,..,m\right)$ that maximizing its relative efficiency score under the restriction that this score is bound by 100% efficiency. If a DMU with its ideal weights receives an efficiency score of 100% - it is efficient, while a score of less than 100% is considered inefficient.
Consider *n* projects, where each project *j* (*j*=1,…,*n*) is characterized by *m* kind of inputs $\vec{X}_j=\left(X_{1j},X_{2j},.....,X_{mj}\right)^T>0$ and by *S* kind of outputs $\vec{Y}_j=\left(Y_{1j},Y_{2j},.....,Y_{sj}\right)^T>0$. The CCR model (output-maximized) for project *k* is formulated as follows:

$$
\begin{aligned}
& h_k = Max \sum_{r=1}^{s} U_r^k \times Y_{rk} \\
& s.t \\
& \sum_{i=1}^{m} V_i^k \times X_{ik} = 1 \\
& \sum_{r=1}^{s} U_r^k \times Y_{rj} - \sum_{i=1}^{m} V_i^k \times X_{ij} \le 0 \quad j=1,....,n \\
& U_r^k \ge \varepsilon > 0 \quad \mathrm{r}=1,2,..,\mathrm{s} \\
& V_i^k \ge \varepsilon > 0 \quad \mathrm{i}=1,2,..,\mathrm{m}
\end{aligned}
\qquad (1)
$$

where ε is an infinitesimal number.
The CCR model assumes that the production function exhibits Constant Returns To Scale (CRTS). The results of the CCR output-maximized formulation are identical to the CCR input-minimized results (Adler et al., 2002).

2.2 ANALYTICAL HIERARCHICAL PROCESS

The Analytical Hierarchical Process (AHP) methodology was developed by Saaty (1980). AHP is methodology to quantify the value of the qualitative/subjective criteria. AHP has been widely used in real-life applications (see a survey in Zahedi 1986, Vaidya & Kumar 2006, Hadad and Hanani, 2011). The AHP is designed for subjective evaluation of a set of alternatives (elements or units in our case) based on multiple criteria, organized in a hierarchical structure. At the top level, the criteria are evaluated and at the lower levels, the alternatives are evaluated by each criterion. The decision maker assesses his evaluation separately for each level and sublevel subjectively. He creates a pairwise comparison matrix in which his subjective evaluation for every pair of items is assessed (Sinuany-Stern et. al., 2000). While AHP has been widely used in real-life applications, there have been some reservations regarding its lack of axiomatic foundations on the utility preferences of the decision maker (see Dyer, 1990 and response Saaty, 1986; Winkler, 1990; Barzilai et al., 1987).
In our case each project manager is evaluated according to several criteria, not all quantitative. The output of AHP is numeric scores of each project manager in each qualitative/subjective criterion. In input of the AHP is a pairwise comparison matrix for every pair of project managers for each qualitative criterion that is created by the decision makers. A common scale of values for pairwise comparison is ranging from 1 (indifference) to 9 (extreme preference). Note that in AHP, the pairwise comparison matrix $A=\left(a_{i,j}\right)_{n\times n}$ on the diagonal has a rank of 1 $\left(a_{i,i}=1\right)$ and the elements $a_{i,j}$ reflect the evaluation of i over j, $a_{i,j}=1/a_{j,i}$ and each element in the matrix is strictly positive - $a_{i,j}>0,\ i=1,2,...,n,\ j=1,2,...,n$ .If $a_{i,j}<1$, it means that i is evaluated less than j .

For *n* project managers and *m* criteria the number of comparisons to be carried out is:

$$m(n^2-n)/2+m(m-1)/2.$$

According to Saaty's definition, the eigenvector $\vec{N}$ of the maximal eigenvalue λ_{max} of each pairwise comparison matrix is utilized for ranking the project managers. For more detail about the AHP methodology see Saaty (1980, 1986, 1990). AHP has been widely used in real-life applications (see a survey in Hadad & Hanani, 2011).
Saaty (1980) defined a statistical measure to test the consistency of the respondent. The statistical measure of the consistency index (CI) is:

$$CI=\mu=\frac{\lambda_{max}-n}{n-1}$$

and the Consistency Ratio (*CR*) is given by:

$$CR=\left(\frac{CI}{RI}\right)100\%.$$

where:
λ_{max} - is the maximal eigenvalue of the matrix,
n - is the number of rows/columns of the matrix,
RI - is the random index. It is the average of the CI for a large number of randomly generated matrices. The values of RI can be found in the table that developed by Saaty (1980, p.51).
The consistency of the decision makers can be checked by the value of CR. Generally, if the CR is 10% or less, the respondent is considered consistent, acceptable, and the computed comparison matrix can be used (Saaty, 1980). If $CR>10\%$, the respondent is not consistent and he/she must correct his/her pairwise estimations.

2.3 RANKING METHODS

There are many different methods for ranking DMUs within the DEA context (for reviews see Adler et al., 2002, Hadad & Hanani, 2011). This sub-section presents two of them.

2.3.1 THE SUPER EFFICIENCY METHOD

One drawback of the DEA methodology is that it does not rank efficient DMUs (those with efficiency scores of 1). To overcome this drawback Anderson & Peterson (A&P) (1993) proposed the Super efficiency ranking method. They suggest allowing the efficient DMUs to receive a score greater than 1 by dropping the constraint that bounds the score of the evaluated the efficient DMU to 1. The A&P formulation for the DMU *k* is follows:

$$
\begin{aligned}
& h_k = Max \sum_{r=1}^{s} U_r^k \times Y_{rk} \\
& s.t. \\
& \sum_{r=1}^{s} U_r^k \times Y_{rj} - \sum_{i=1}^{m} V_i^k \times X_{ij} \le 0 \quad for\ j = 1,2,..,n,\ j \ne k \\
& \sum_{i=1}^{m} V_i^k \times X_{ik} = 1 \\
& U_r^k \ge \varepsilon > 0 \qquad r = 1,2,..,s \\
& V_i^k \ge \varepsilon > 0 \qquad i = 1,2,...,m
\end{aligned}
\tag{2}
$$

2.3.2 THE CROSS EFFICIENCY METHOD

Other drawback of the DEA methodology is that it does not use common weights while evaluating the efficiency of DMUs. To overcome this drawback Sexton et al. (1986) proposed the Cross Efficiency (CE) ranking method. This subsection presents the steps for setting the score of each DMU by the CE.

Step 1 – Find the optimal weights $u_r^k \ \left(r = 1,2,...,s;\ k = 1,2,...,n\right)$ and $v_i^k \ \left(i = 1,2,...,m;\ k = 1,2,...,n\right)$ by the CCR model.

Step 2 – Calculate the elements of the cross-evaluation matrix as follows:

$$
h_{k,j} = \frac{\sum_{r=1}^{S} u_r^k \times Y_{r,j}}{\sum_{i=1}^{m} v_i^k \times X_{r,j}},\ k = 1,2,...,n,\ j = 1,2,...,n\ .
$$

Thus, $h_{k,j}$ represents the efficiency given to DMU j in the CCR run of DMU k (the efficiency of DMU j by the optimal weights of DMU k).

Step 3 - Calculate the score for each DMU j as follows:

$$
\bar{h}_j = \frac{\sum_{j=1}^{n} h_{k,j}}{n} \tag{3}
$$

Step 4 – Rank the DMUs according to the scores $\bar{h}_j$, $j = 1,2,...,n$. The DMU with the highest score will be ranked first and so on.

2.4 INPUTS AND OUTPUTS FOR RANKING PROJECTS

Many quantitative criteria can be used to compare the relative performance success of completed projects. The decision makers must determine the appropriate criteria for projects evaluation and how they can be measured. The criteria should reflect the organization's objectives and the projects type. In order to use ranking method in the DEA context the criteria must be classified into inputs and outputs. Hadad et al. (2013) proposed the following inputs and outputs:

Input 1- The cost stabilization coefficient of project i .

$$
X_{1,i} = \frac{E(C_i)}{\sigma(C_i)} \tag{4}
$$

Where

$E(C_i)$ - the i-th project's expected cost.

$\sigma(C_i)$ - the i-th project's standard deviation cost.

$X_{1,i}$ - the coefficient of variation (Levy and Sarnat, 1995).

Input 2- The completion time stabilization coefficient of project i.

$$X_{2,i} = \frac{E(T_i)}{\sigma(T_i)} \tag{5}$$

Input 3- The reciprocal of the intensity of project i.

$$X_{3,i} = \frac{E(T_i)}{E(C_i)} \tag{6}$$

Output 1- The ratio between the expected cost and the actual cost of project i.

$$Y_{1,i} = \frac{E(C_i)}{e(C_i)} \tag{7}$$

Where $e(C_i)$ is the i-th project's implementation expenses.

Output 2- The ratio between the expected and the actual completion time of project i.

$$Y_{2,i} = \frac{E(T_i)}{e(T_i)} \tag{8}$$

Output 3- The ratio between the actual cost, excluding implementation expenses, and the implementation expenses of project i.

$$Y_{3,i} = \frac{e(C_i)}{l(C_i)} \tag{9}$$

where $l(C_i)$ is the i-th project's implementation expenses.

Output 4- The ratio between the actual completion time, excluding the implementation duration, and the implementation duration of project i.

$$Y_{4,i} = \frac{e(T_i)}{l(T_i)} \tag{10}$$

3. CANDIDATES RANKING

This section presents the steps of the proposed method that allows full rank of the candidates. The rank is carried out according to the average scores of the projects that each project manager performed in the past, and according to the scores of his personal qualitative criteria.

Step 1: Define the candidates to be evaluated. For each candidate k, $k = 1,2,...,K$, determine the projects that will be used for candidate ranking $l = 1,2,...,L_k$. L_k is the number of the projects that according to them candidate k will be evaluated.

Step 2: Calculate for each project k,l the input and output values according to equations $(4),...,(10)$, respectively.

Step 3: Select one of the ranking methods (section 2.3) and compute the level of performance, $F_{k,l}$, for all the projects k,l, $k = 1,2,...,K;\ \ l = 1,2...,L_k$. For A&P ranking method use equation (2) to compute $F_{k,l}$. For the CE ranking method use equation (2) to calculate the optimal weights and then compute $F_{k,l}$ via equation (3).

Step 4: The average level of past performance of candidate k is calculated as follows:

$$F_k = \frac{1}{L_k} \sum_{l=1}^{L_k} F_{k,l} \quad (11)$$

Step 5: Determine the qualitative personal criteria that according to them the candidates will be evaluated. For each criterion t, $t = 1,2,...,T$ perform pairwise comparison according to AHP methodology and create a pairwise comparison matrix A_t. Calculate for these matrixes $\lambda_{t,max}$ and the consistency ratio CR_t. If $CR_t \leq 10\%$, go to the next step. If not, the pairwise comparison must be modified.

Step 6: Calculate the normalized eigenvector $\vec{N}_t$ $(t = 1,2,...,T)$ of the maximal eigenvalue $\lambda_{t,max}$. The elements of this vector, $P_{k,t}$, represent the score of candidate k in criterion t.

Step 7: Determine the relative weights, W_t $(t = 1,2,...,T,T+1)$ for all the criteria (qualitative and quantitative). Note that there are T criteria that represent the qualitative attributes of the candidate and one quantitative criterion that represents his/her past performance level. The relative weights can be set directly by the decision makers, or subjectively by AHP or objectively by DEA.

Step 8: The final score of each candidate, S_k, is the weighted score he/she obtained in all the criteria. This score is calculated as follows:

$$S_k = \sum_{t=1}^{T} W_t \times P_{k,t} + W_{T+1} \times F_k$$

Step 9: Rank all the candidates by S_k. The candidate with the highest S_k is ranked first and so on.

4. CONCLUSIONS

This paper proposes a method that uses DEA, AHP methodologies and ranking method for selecting the best candidate for a managing a project. The proposed method allows calculating the weighted score and the rank of each candidate according to quantitative and qualitative criteria. It is important to select the appropriate criteria for the ranking because the selected criteria have influence on the final rank. The values of the criteria (quantitative and qualitative) are based on the past performance of the candidates. Therefore it is applicable only for experienced candidates. The proposed method can be used in project oriented organizations such as building companies and software companies, where all the projects have similar characters.

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APPLICATIONS OF RANKING INDEXES OF PROJECT ACTIVITIES FOR PROJECT MANAGEMENT TASKS

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Abstract: *This paper reviews ranking indexes of project activities for project management tasks. The ranking of project activities in one project is applicable for focusing the project manager attention on the important activities. The selection of the appropriate ranking indexes should be done according to the managerial purpose: 1) Paying attention to activities throughout the execution phase and in the resources allocation process in order meet the determined qualities, and to deliver the project on time and within budget, i.e., to accomplish the project within the "iron triangle" 2) Setting priority in order to share the managerial care and control among the activities. The paper proposes to use multi-criteria ranking methods in order to rank the activities in a case where several ranking indexes are selected.*

Keywords*: Project Management (PM), Ranking Indexes (RI), Multi-Criteria Ranking Method (MCRM), Analytical Hierarchical Process* (AHP).

1. INTRODUCTION

Project is a complicated task that requires coordinated efforts to achieve a set of goals. These goals are typically: meeting the determined qualities, delivering the project on time and within budget (the iron triangle). Other goals can be performing the project according to the organization culture and rules and minimizing the interruptions to other activities. Keren and Cohen (2012) developed a formulation that reflects a triangular trade-off structure between the project objectives: time, budget, and quality. The major challenge of the project manager is carrying out a balanced distribution of his managerial efforts between various project tasks, activities and objectives (Hadad and Keren, 2013).

The project program should be prepared initially, taking into consideration the set of the project activities with their precedence priorities and the possible execution modes of each activity (Laslo & Gurevich, 2013a). The planning of the project includes optimization allocation of the project activities' budgeting, i.e., minimization of the total budget subject to on time accomplishment of the project. Such optimizations of multi-mode optimization problems are performed via the Critical Path Method (CPM) time-cost tradeoffs procedure (Kelley & Walker, 1959; Kelley, 1961) when deterministic duration of all project activities is considered. In a case of project with stochastic durations, a semi-stochastic time-cost tradeoffs procedure (Golenko-Ginzburg, 1993) or a stochastic time-cost procedure (Laslo & Gurevich, 2013b) are performed. Recently, many heuristics for multi-mode resource-constrained scheduling optimization problems have been tested on sets of benchmark instances from the PSPLIB library (Kolisch & Padman, 2001; Kolish & Hartman, 2006)). However, the uncertainty throughout the project's lifecycles disables following the initial timetable, and thus, the practice requires a dynamic scheduling routine where in cases of resource shortages during the project execution decisions should be reconsidered and taken via dispatching. When the decision-making is based on the deterministic approach, the MINSLACK dispatching was found very effective for the reestablishment of the project's time target (Davis & Patterson, 1975). Considering uncertain durations of project activities, Laslo (2010) introduced for this purpose a heuristic pairwise dispatching that raises the probability confidence of accomplishing the project on time. The dynamic scheduling determines which of the project activities is in process at each point during the execution of the project.

When several activities are processed simultaneity, it is important to rank the activities according to their relative importance in keeping the project performances within the iron triangle. Such rank enables the project manager to focus his/her managerial efforts and control in the most important activities and by that to increase the probability for a project success. This paper reviews several ranking indexes that help to rank the project activities in process by their importance for attaining the project targets. By selecting an appropriate ranking index a project manager can rank all these activities. If the project manager prefers to use several ranking indexes, he/she must set relative weights for each selected index. The most important activities would be managed by the project manager himself/herself (similar to the Pareto principle). The values of the relative weights can be determined by subjective methods such as: Analytical Hierarchical Process (AHP) (Satty, 1980); ELECTRE (Roy 1989, 1990); Simple Multi-Attribute Technique (SMART) (Edwards 1977, Edwards and Barron 1994) or by the decision makers. The values of the relative weights can be determined by objective methods via Data Envelopment Analysis (DEA) (Charnes et al., 1978) such as the Super Efficiency (Anderson and Peterson, 1993); Canonical Correlation Analysis (Friedman and

Sinuany-Stern, 1997); Global Efficiency Method (Ganley and Cubbin,1992); Cross Efficiency Method (Sexton et al., 1986). For reviews see Adler et al. (2002), Hadad and Hanani (2011).
Ranking of the project activities can be done for two distinguished goals. The first goal is for setting priority for performing the activities and for resources allocation in order to meet the due date. The second goal is for setting priority in order to share the managerial care and control among activities. Ranking indexes that important for meeting the due date are the minimum slack (the difference between the latest and earliest start time of the activity) in a deterministic case and the Significance Index (SI) (Williams, 1992); Activity Criticality Index (ACI) (Van Slyke ,1963, Martin, 1965); Cruciality Index (CRI) (Williams, 1992, Elmaghraby, 2000); time–cost tradeoffs under uncertainty (Laslo and Gurevich, 2013) and others in a stochastic case. These indexes are presented in the next section. Ranking indexes that useful for sharing the managerial care and control are related to the cost, duration and risk of an activity. Several indexes of this type are also presented in the next section.
Furthermore, the importance of the activities is dynamic and can be changed during the project execution. Therefore in every major mile stone the project manager must recalculates the ranking indexes taking into account the current status of the project. In other words, when several activities have been completed – the ranking of the uncompleted activities should be carried out again. Milestones are events in a project that divide the project into stages for monitoring and measurement of work performance. These events typically indicate a completion of a major deliverables of a project.

2. RANKING INDEXES FOR PROJECT ACTIVITIES

The Critical Path Method (CPM) is developed in the 1950's. It represents a project as an activity network as a graph that consists a set of nodes $N=\{1,\ 2,\ \ldots,\ n\}$ and a set of arcs $A=\{(i,\ j\ )\,|\,i,\ j\in N\}$. The nodes represent project activities whereas the arcs that connect the nodes represent precedence relationships. Each activity j has either deterministic activity duration t_i or a stochastic duration. Each activity can start after all its predecessors have completed. CPM uses an early-start schedule in which activities are scheduled to start as soon as possible. However, most projects are not deterministic since they are subject to risk and uncertainties due to external factors, technical complexity, shifting objectives/scopes, and poor management. In practice, project risk management includes the process of risk identification, analysis, and handling (Gray and Larson, 2005).
Ranking indexes enable the ranking of project activities based on the impact they have on project objectives (Creemers et al., 2010, 2011, 2014). This section presents the ranking indexes that will be used for calculating the scores of each project activity. The first indexes are related to the duration of the project and to the duration risks (2.2), and the rest are related to the cost and to the managerial care.

2.1 NOTATIONS

This sub-section presents the notations that are used for determined the ranking indexes.
$\mu(t_i)$ - The expected duration of activity $i\ (i=1,2,...,n)$.
$\sigma(t_i)$ - The standard deviation of the duration of activity $i\ (i=1,2,...,n)$.
$\mu(c_i)$ -The expected cost of activity $i\ (i=1,2,...,n)$.
$\sigma(c_i)$ - The standard deviation of the cost of activity $i\ (i=1,2,...,n)$.
t_i^k - The duration of activity $i\ (i=1,2,...,n)$ in simulation run $k\ (k=1,2,...,K)$.
c_i^k - The cost of activity $i\ (i=1,2,...,n)$ in simulation run $k\ (k=1,2,...,K)$.

2.2 RANKING INDEX FOR DURATION OF AN ACTIVITY

In this sub-section the ranking indexes for the duration of an activity are presented. For a more detailed discussion on the ranking indices presented below, refer to Elmaghraby (2000), Demeulemeester and Herroelen (2002).

2.2.1 RANK POSITIONAL WEIGHT (RPW)

Hadad and Keren (2013) suggested to use the Rank Positional Weight (RPW) index that developed by Helgeson and Birnie (1961) for ranking index for duration of activity. The RPW of an activity is the sum of the duration of all activities following the activity in the precedence network, including the duration of the activity itself. The RPW is calculated by:

$$RPW = \frac{1}{K}\left(RPW^1 + RPW^2 + ... + RPW^K\right) \quad (1)$$

where

RPW^k -The RPW index of simulation run $k\ (k = 1,2,...,K)$ is computed by the equation $RPW^k = A \times t^k$.

In this equation, A is the $(n \times n)$ fixed precedence matrix with elements $a_{i,j} = \begin{cases} 1 & \text{if } i = j \text{ or } i \prec j \\ 0 & \text{otherwise} \end{cases}$

2.2.2 SIGNIFICANCE INDEX (SI)

The Significance Index (SI) was developed by Williams (1992). In order to better reflect the relative importance between project activities, the sensitivity index of activity i has been formulated as follows:

$$SI_i = \frac{1}{K}\sum_{k=1}^{K}\left(\frac{t_i^k}{t_i^k + TF_i^k}\right)\left(\frac{T_{\max}}{\bar{T}}\right) \quad (2a)$$

The SI is usually estimated by simulation methods (Vanhoucke, 2010), and is calculated by:

$$SI_i = \frac{1}{K}\sum_{k=1}^{K}\left(\frac{t_i^k}{t_i^k + TF_i^k}\right)\left(\frac{T^k}{\bar{T}}\right) \quad (2b)$$

where

t_i^k - duration of activity $i\ (i = 1,2,...,n)$ in simulation run $k\ (k = 1,2,...,K)$.

TF_i^k - total float of an activity $i\ (i = 1,2,...,n)$ in simulation run $k\ (k = 1,2,...,K)$. (Refer to Demeulemeester and Herroelen (2002) for a definition of total float).

T - total project duration (a random variable).

T^k - total project duration in simulation run $k\ (k = 1,2,...,K)$.

$\bar{T}$ - average project duration over K simulations.

2.2.3 COEFFICIENT OF VARIATION (CV) FOR ACTIVITY DURATION

The coefficient of variation (CV) is often used as a risk measure for time and cost (Levy and Sarnat, 1995). Yeo (1991) claimed that the CV can be used as a reasonable measure of cost variation and as a complement to the sensitivity measures. Khorramshahgol (1988); Khorramshahgol and Steiner (1988); Khorramshahgol and Vassilis (1988) used the CV for project evaluation and selection. The coefficient of variation for the duration of activity i is computed by:

$$CV(t_i) = \frac{\hat{\sigma}(t_i)}{\bar{t_i}} = \frac{\left(\frac{1}{K-1}\sum_{k=1}^{K}\left(t_i^k - \bar{t_i}\right)^2\right)^{\frac{1}{2}}}{\bar{t_i}} \quad (3)$$

2.2.4 ACTIVITY CRITICALITY INDEX (ACI)

A common practice in project risk management is to focus mitigation efforts on the critical activities of the deterministic early-start schedule (Goldratt, 1997). The Activity Criticality Index (ACI) was developed by Van Slyke (1963) and later by Martin (1965). The ACI index of activity i is computed by:

$$ACI_i = \frac{1}{K}\sum_{k=1}^{K}\delta_i^k, \quad \delta_i^k = \begin{cases} 1 & \text{if } i \text{ is critical in simulation run } k \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

For more details about the activity criticality index see Creemers et al. (2010, 2011).

2.2.5 CRUCIALITY INDEX (CRI)

The Cruciality Index (CRI) was developed by Williams (1992) and Elmaghraby (2000). This index defined as the absolute value of the correlation between the activity duration and the total project duration. The CRI of activity i is computed by:

$$CRI_i = \left|\text{corr}\left(t_i^k, T^k\right)\right| \quad (5a)$$

Cho and Yum (1997) suggested calculating the cruciality index according to Spearman's rank correlation. This measure is computed as following:

$$CRI_i = \left|1 - \frac{6}{K(K^2-1)}\sum_{k=1}^{K}\left(\text{Rank}(t_i^k) - \text{Rank}(T^k)\right)^2\right| \quad (5b)$$

2.2.6 SCHEDULE SENSITIVITY INDEX (SSI).

Cho and Yum (1997) proposed to measure the impact of the variability in activity durations on the variability of the project completion time. Their uncertainty importance measure (UIM) is evaluated as flowing:

$$UMI_i = \frac{Var(t_i)}{Var(T)} \quad (6a)$$

The PMI Body of Knowledge (2008) and Vanhoucke (2010) defined a ranking index- SSI that combines the ACI and the variance of t_i (duration of activity i) and T (total project duration). The Schedule Sensitivity Index (*SSI*) is computed as following:

$$SSI_i = ACI_i \sqrt{\frac{Var(t_i)}{Var(T)}} \quad (6b)$$

2.2.7 CRITICAL DELAY CONTRIBUTION (CDC)

The Critical Delay Contribution (CDC) was developed by Creemers et al. (2014). The CDC redistributes the project delay over the combinations of activities and risks that cause the delay. The term $CDC_{i,e}^{(E)}$ represents the proportion of the project delay that originates from the impact of a risk $e : e \in E$ on an activity i and is computed as following:

$$CDC_{i,e}^{(E)} = \frac{1}{K}\frac{\sum_{k=1}^{K} m_{i,e,k} \times \delta_{i,k}^{(E)}\left(T_k^{(E)} - T\right)}{\sum_{i\in N}\sum_{e\in E}\sum_{k=1}^{K} m_{i,e,k} \times \delta_{i,k}^{(E)}} \quad (7)$$

where $m_{i,e,k}$ is the random variable of the risk impact of a risk e on the duration of an activity j in simulation k. $\delta_{i,k}^{(E)}$ equals 1 if *j* is critical in simulation k and 0 otherwise.

2.3 RANKING INDEX FOR COST

In this sub-section the ranking indexes for the cost of an activity are presented. For more details see Hadad and Keren (2013).

2.3.1 EXPENDITURE RATE (ER)

The Expenditure Rate (ER) was used by Hadad and Keren (2013) as a ranking index for project activities. The expenditure rate of activity i, ER_i, is calculated by:

$$ER_i = \frac{1}{K}\sum_{k=1}^{K}\frac{c_i^k}{t_i^k} \quad (8)$$

Where

c_i^k is the cost of activity i in simulation run k.

2.3.2 COEFFICIENT OF VARIATION (CV) FOR ACTIVITY COST

The coefficient of variation for the cost of activity i is computed by:

$$CV(c_i) = \frac{\hat{\sigma}(c_i)}{\overline{c}_i} = \frac{\left(\frac{1}{K-1} \sum_{k=1}^{K} \left(c_i^k - \overline{c}_i \right)^2 \right)^{\frac{1}{2}}}{\overline{c}_i} \quad (9)$$

3. A PROCEDURE FOR RANKING PROJECT ACTIVITIES

In order to rank project activities according to their importance the following procedure is proposed.

Step 1: Plan the project and collect data: Build the CPM network and set milestones. Determine duration and budget for each activity. Estimate the excepted values and the variances for each activity.

Step 2: Determine the managerial objectives (meeting the due date and/or sharing of the managerial care and control) and select the appropriate ranking indexes that would support these objectives.

Step 3: Simulate the project and obtain the needed values for calculation of the selected ranking indexes (durations, costs, variances, criticality, etc.). Calculate the values of the indexes for each activity.

Step 4: If only one ranking index is selected – all the activity should be ranked according to the value of this index (step 5). If several ranking indexes are selected then a multi-criteria ranking method must be selected (e.g., AHP, DEA). The weights of the indexes must be determined and the weighted score of each project activity is calculated.

Step 5: Rank the uncompleted activities of the project in descending order according to their scores. One rank is for supporting the objective of meeting the due date and the second rank is for sharing of the managerial care and control.

This procedure must be performed at each milestone for the uncompleted activities.

4. CONCLUSIONS

This paper reviews ranking indexes of project activities for project management tasks. The ranking indexes can be used for focusing the attention of the project manager on the important activities and to spread correctly his/her managerial efforts and control among the activities. The ranking of the project activities is useful for two distinguished goals: 1) Prioritizing activities in execution and in resources allocation in order to meet the due date. 2) Setting priority in order to share the managerial care and control among the activities. The paper proposes to use multi-criteria ranking methods in order to rank the activities in a case where several ranking index are selected. Note that the decision makers must select the proper indexes for the activities ranking. The selection of the appropriate ranking indexes is very important task because different indexes yield different rank. Moreover, one can find after the indexes selection that some of the indexes are highly correlated with other indexes. In such case one must decide which indexes would be removed.

The proposed method solves the difficulty of determining the relative weights for each ranking index that is used for the ranking by using mathematical methodology (DEA). The proposed method is useful for a project with many activities or for a program that includes several projects which are executed in parallel. In these cases the proposed method allows the project manager to share his or her managerial efforts and care among the activities.

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PROJECT SUCCESS ANALYSIS: EVIDENCE FROM SERBIA

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Abstract: *This paper presents the basic concepts for defining the project success and it-s measurement. Based on the literature review, the research was conducted to investigate: 1) the level of development of project management in project-based organizations in Serbia, 2) the level at which the organizations define project success factors and key performance indicators and 3) whether they are used for assessing the project success. The main conclusion is that the success factors of the project, taking into account the organizational and external environment factors are defined in something more than 1/3 of respondent's organizations. The almost same situation is present when we consider performance indicators, and their usage in evaluating the project success, considering organizations in Serbia.*

Keywords*: Project, success, analysis, CSF, KPI.*

1. INTRODUCTION

Project managers today are faced with many challenges of project management specially with the need for fast decision making in selection of an appropriate project and how to make the best use of existing knowledge and information from previous projects in order to avoid waste of resources and achieve better results for further projects.

One of the most common ways of gathering information about the project is the analysis of achieved project results, or in other words, achieved project success. However, the biggest challenge in measuring and analyzing the project success is the transfer of something that is defined as a success or success factor at the operational level, through measurable indicators that will allow the evaluation of the project during and after it's implementation. The starting point of this statement is the organization observation through its four perspectives (according to BSC concept every organization has four perspectives: financial perspective, customer perspective, the perspective of learning and development and internal processes) where only the usage of the strategic map enables the concretion of measures for analysis and evaluation of organizational performances. Similarly, it can be concluded that defined success factors must be transferred to the operational level and become measurable in order to analyze the success of the project .

Below are presented the Critical Success Factors - CSF and Key Performance Indicators - KPI as concepts for project success analysis, along with empirical research that examines the usage of CSF and KPI in project success assessment.

2. PROJECT SUCCESS ANALYSIS TROUGH ITS DEFINITION AND MEASUREMENT

Retrospective of understanding/perception of project success can be shown through three stages. The first stage is a theoretical interpretation of the project success (Pinto and Slevin, 1988a; Baker et al., 1988 cited in Prabhakar (2008); Shenhar et al., 2001; Abdullah and Ramly, 2006; Olsson et al., 2010). The second stage consists of empirical research on the factors that contributes to the project success, resulting in list(s) of critical success factors. The idea of CSF was created with the paper published in Harvard Business Review in 1961. on the topic Management Information Crisis, but the first article which defines the term CSF was published in 1979. According to Rockart (cited in (Fortune & White, 2006)) CSFs are: limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. Khandelwal and Ferguson (1999) believe that the definition of success factors present the preconditions for measuring the development of the organization. By applying this approach the scope of project management has been expanded.

Belassi & Tukel (1996) in their work give an overview list of CSFs developed during 70th and 80th in XX century. Researches that led to the formation of the list of CSFs conducted from 90th of the last century are presented in (Freeman and Beale, 1992; Cooke-Davis 2002; Judgev and Muller, 2005; Shenhar et al., 2005; Kerzner, 2011; Diallo and Thuillier, 2012), however, the general conclusion is that there are CSFs which are typical for most projects and that usually were replicaed in these studies, but there is no single list of CSFs,

which can be applied to all projects. CSFs have a role in the business processes controle and according Van Veen-Dirks and Wijn (2002) „controle process begins with the CSF identification". The authors link the concepts of Balanced Scorecard and CSF and claim that the Balanced Scorecard can be used as a diagnostic control system, however CSF allow managers to define the areas that leads to success. The outcome of this process of CSFs identification should be used as a starting point for the Balanced Scorecard. The advantage of using CSFs is that the measurement system can be more associated with the environment.

The third phase streams to development of concepts and models for representing the project success as presented through the perspective of stakeholders (Anbari et al, 2008), life-cycle stages (Yu et al., 2005) and value-centered approach (Freeman and Beale, 1992; Yu et al., 2005).

One of the key challenges of managing project-oriented organizations is how to measure project success in a manner that will contribute to the success of the entire organization? The organizations, whose management models were multiple awarded, have based their management systems on the model of corporate performance management (Paladino, 2011). However the key to success is not in simple definition of performance measures but in defining key performance measures that will serve as a guide for behavior in the organization. The key performance measures are the base for obtaining key performance indicators (KPI), which due to its role in decision-making can have a big impact on the efficiency of organizational management.

There are a several researches conducted in this field by Eckerson (2006), Kerzner (2001), Franceschini et al. (2007), Hubbard (2007) and others who worked on definition of characteristics and categories of KPIs, interdependence of KPI, and the possibility of an integrated performance measurement.

According to Eckerson (2006) KPIs are measures that show how well the organization or individual is performing the operational, tactical and strategic actions that are critical to current and future success of the organization. The first step in selection of the right KPIs is to define the general and specific characteristics that KPIs should satisfy. It can be concluded that conversion of measures in KPI can be performed by reexamine whether the measures meet KPIs criteria (predictable, measurable, actionable, relevant, and automated). If all criteria are met, the measure is KPIs. Notice that the rating of met criteria provides key answers in creating the list of the most important KPIs. Also what can be helpful are the following questions: what is the decision KPI is supposed to support; what really is being measured with KPI; why does this thing matter to the decision being asked; what is known about it now; what is the value to measuring it further (Hubbard, 2007).

Having this facts in mind the aim of this paper was to investigate whether a project-oriented organization in Serbia define CSFs for their projects, whether and how they measure the success of their projects. The main research questiones were:

1. How is the project management process regulated in the organization?
2. Whether and how the organizational processes and procedures an external environment influence the project success?
3. Wherether CSFs are defined on project?
4. In what way the project success is measured and evaluated?
    a) What are the most frequent ways to evaluate the performance of projects?
    b) Do the organizationes define the projects KPIs?
    c) Are the KPIs used in the analysis of the project success?

3. EMPIRICAL RESEARCH

3.1. Research method and sample description

The authors had composed a questionnaire in order to examine does the project-oriented organizations define project success and how, and how they, measure project success (if the answer on the previous question was positive). The questions were based on literature overview and previous studies in this field. Afterwards, the authors conducted structured interviews with project managers in different industries, after which the questions were modified in order to generate the most precise answers.

Out of 400 distributed questionnaires to project managers in different industries (i.e. construction sector, IT sector, energy sector, public sector, education, NGO, agro-industry) 107 or 26,75% participants have completed the survey, 4 questionnaires have been rendered as inadequate on the grounds of being

incomplete. Therefore, only 103 questionnaires have been taken into consideration. The following chapter presents the results of the research processed in SPSS 17.0.

3.2. Findings

54% of respondents were project managers or coordinators of several projects, while the remaining respondents were project team members. As much as 45% percent of them participated in over 15 projects, 93.2% of respondents have university degree. Besides the abovementioned demographic data, the research also encompassed questions relating to the definition and measuring of project success.

The next part of the survey relates to the project management process and on the examination of whether and to what extent CSFs are defined on the project. Within the segments relating to the definition of CSFs following questions were asked:

- Whether the organizational processes and procedures have the influence on project success?
- Whether the organization has documented procedures for the project management?
- Wherether factors from an external environment have the influence on the project?
- Do you define CSFs for your project, considering the organization and factors in the external environment ?
- Who is responsible for defining the CSF project?

According to the survey 96.1% of respondents said that the internal documentation (organizational processes and procedures) have the influence on project success. Respondents ware offered scale of 1 to 5 to assess the impact of the individual procedures and processes in organizations that mainly affect the project success (table 1) showed that the biggest impact on project success has an existing technology (the mean is 3.83), even the variance is the lowest one compared to the rest of organizational procedures and processes. The next one is a business policy (mean is 3.81), than a development strategy (mean 3.71), recent projects (mean 3.69) and a human resource policy (mean 3.61).

Table 1. Organizational procedures and processes procedures impact assessment on the project success

		Org. procedure and processes	Development strategy	Business policy	Human resource policy	Technology	Recent projects
N	Valid	103	103	103	103	103	103
	Missing	0	0	0	0	0	0
Mean			3.74	3.81	3.61	3.83	3.69
Median			4.00	4.00	4.00	4.00	4.00
Std. Deviation			1.038	.919	1.022	.879	1.039
Variance			1.078	.844	1.044	.773	1.079

71.8% of respondents said their organizations have the procedures for project management, while 5.8% did not know the answer on this question. But when they were offered the scale of 1 to 5 to assess the degree of the regulation of individual sub-processes of project management process, the average score was ranged between 3 and 4 (on scale from 1 to 5). It is interesting that higher scores have the process of project planning, project monitoring and reporting on progress and completion of the project, while the processes of project initiation and selection were assessed with the lower grades (average grades ranging from 3 to 3.5). When asked whether factors from the external environment have influence on their project, 97.1% of the respondents answered in the affirmative.

On the question of whether the CSF are defined on their projects, considering the organizational and factors from the external environment, only 36% of respondents said yes, 2.9% said that the critical success factors is not defined, while 61.2% did not know the answer to this question.

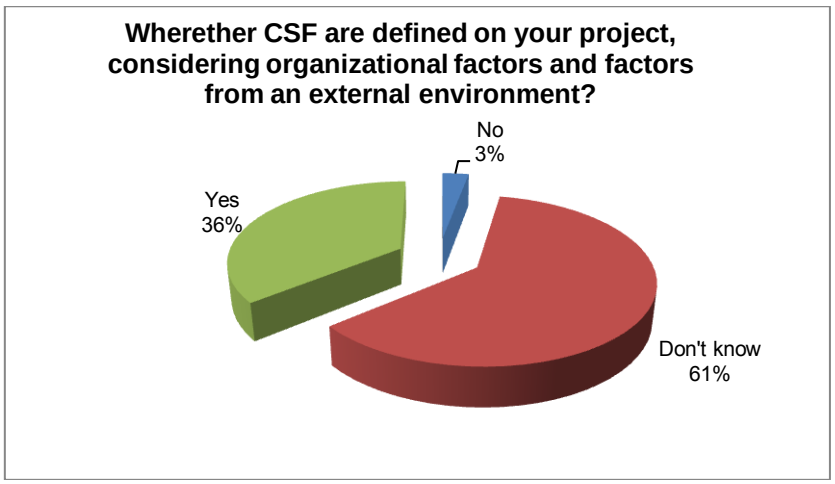

Figure 1. Definition of CSF

Respondents who have previously answered the question in the affirmative said that CSF are determined by top management (40.5%), project manager at 29.7% situation, while the CSF is defined by team members in 13.5% situations.

The next group of questions relates to measuring the project success:

- Is there a defined procedure of project performance evaluation at the project level?
- Do you establish performance measures for the evaluation of the project performances?
- What performance measures are used in the evaluation of the project?
- Do you define a set of KPI for your project?
- Who is responsible for determining the KPI?

In most cases (54.4%) there is no defined procedure of project performance evaluation at the project level, but it is done at the organizational level, while 42.7% of respondents reported that, in their organizations, there is a defined procedure of performance evaluation at the project level. Based on these results it can be concluded that the performance evaluation of the project carried out in 97.1% of cases.

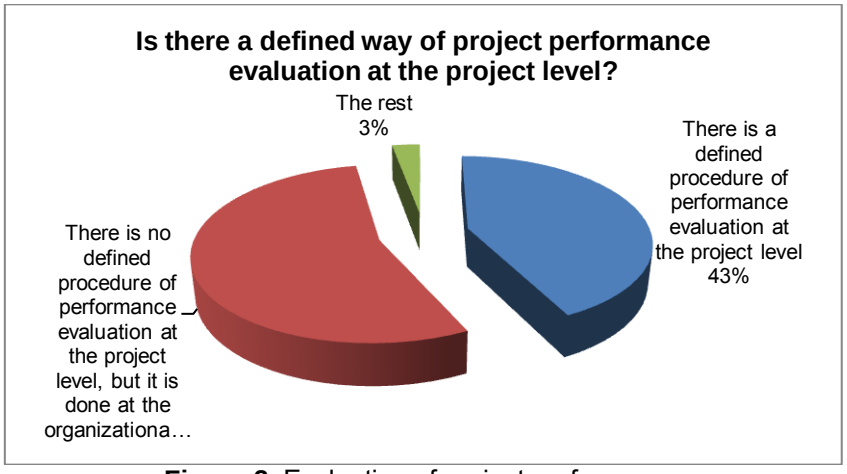

Figure 2. Evaluation of project performance

Slightly more than half of the respondents answered that they determines the performance measures for the evaluation process while 35% of respondents said they do not.

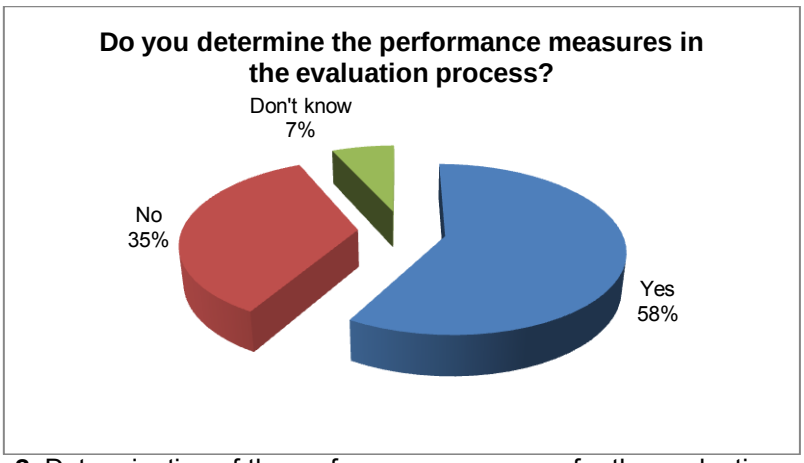

Figure 3. Determination of the performance measures for the evaluation process

The most commonly used measures to evaluate the project performance are: actual cost, the actual time, the technical characteristics of the product of the project, the level of quality etc.). In a much lesser extent (only 16%) used financial measures such as NPV, ROI, payback period etc., while measures related to the process of project management as well as process efficiency and labour productivity are used in only 1% of cases. About 14% of respondents written its own response, and the most of them said that they use a combination of measures related to the project and financial measures.

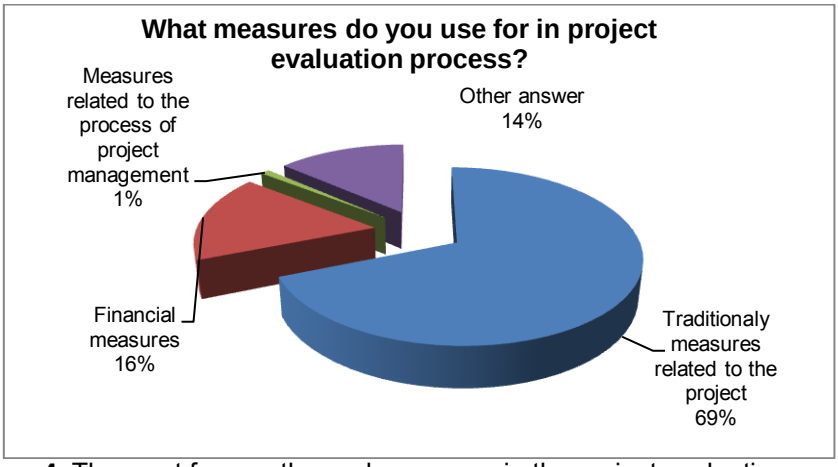

Figure 4. The most frequently used measures in the project evaluation process

34% of respondents determines KPI, only 7% of respondents did not define KPI for the project, while 59% of respondents did not answer to this question.

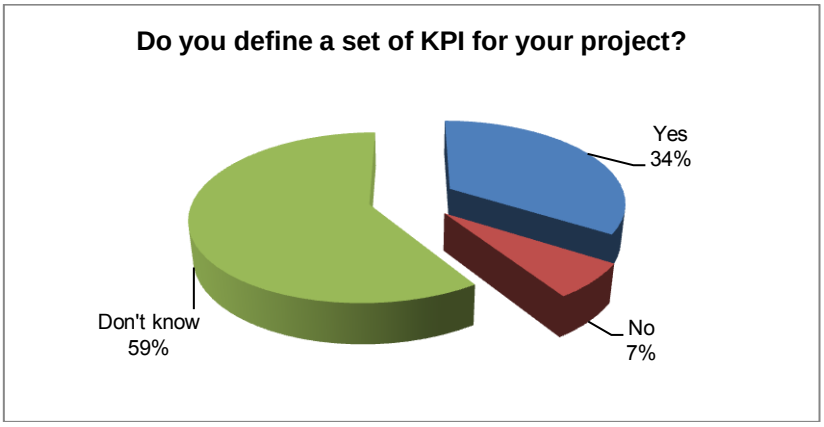

Figure 5. KPI definition

Unlike those responsible for determining the CSFs, the responsible person(s) project KPIs definition in 40% of situations are project team members, in about 34% of the situation the responsible person is project manager, while the participation of top management is in much smaller percentage (14%). Based on a

comparison of the obtained answers to these two questions, it can be concluded that the determination of KPIs more operational and technical issue and is usually in the area of competence of project managers and team members, while the determination of CSFs is more an issue that is considered in terms of the whole organization, by management.

Of those who responded that they define KPIs, 63% are using KPIs to assess the success of the project.

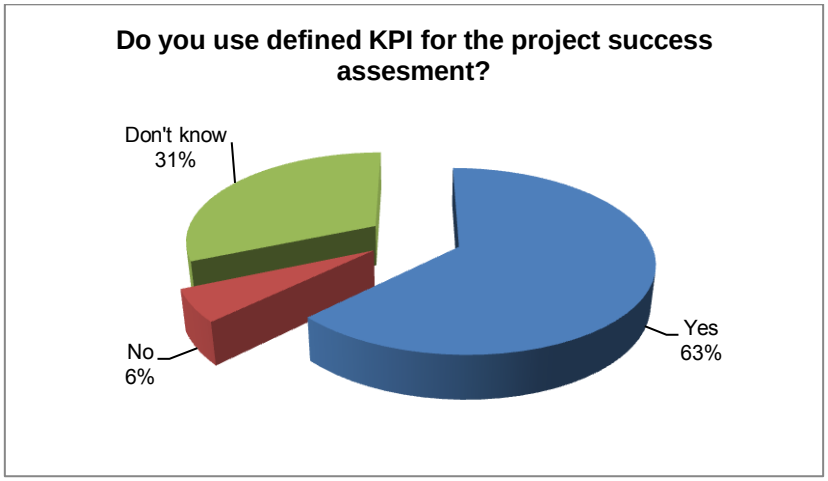

Figure 6. The usage of KPI in project success assessment

4. CONCLUSION

More than 70% of project oriented organizations have project management procedure defined, but the sub-processes that are well regulated are project planning, project monitoring and reporting on progress and completion of the project. The processes of initiation, selection and initiation of the project assessed the lower grades. The organization are aware that factors from external environment can affect the success of their projects, as well as organizational processess and procedures but very small percentage defined project success trough success factor considering those influences. The main conclusion of this paper is that the success factors of the project, taking into account the organizational and external environment factors are defined in something more than 1/3 of organizations. The almost same situation is present when we consider performance indicators. Their usage in evaluating the project success is at a very low level when it comes to organizations in Serbia. The research results show that the definition of CSF is in responsibility of organization management in the most of cases, like this is a more strategic issue. That is very much in line with the literature that link Balanced Scorecard and CSF (Van Veen-Dirks and Wijn, 2002) according to witch Balanced Scorecard can be used as a diagnostic control system and CSF allow managers to define the areas that leads to success (CSF identification should be used as a starting point for the Balanced Scorecard). On the other hand KPIs determination is, regarding presented results here, more operational issue, under the responsability of project team and project manager.

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RISK MANAGEMENT METHODS: HOW TO DEAL WITH RISKS IN A PROJECT

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Abstract: *Projects have complex nature in many fields. That is why during the project implementation many unpredicted situations could be encountered. The answer to the question what can help to deal with them before they occur is that by implementing methods of risk management the project team will have greater control over the overall management of the project. Software project involves many uncertainties, that if not controlled, project will be exposed to risks during the development phases as well as throughout the project life cycle. Every method of risk management has its specific area of application and can be used in order to cut down the risk element of a project to a minimum. Because of the need for cost saving in software development projects, it is important to manage risks during the early project development phases. Then risks can easily be maintained at an acceptable cost level.This paper will emphasize the features, similarities and differences between methods that can be used as tools to minimize risk in software projects: BOEHM method, RISKIT method and GSRM - Goal-driven Software Development Risk Management Model. Methods are different by their nature, but risk management process within the methods provide a structure to ensure visibility into risks and at the end to achieve project success.*

Keywords: *risk, project, risk management method*

1. INTRODUCTION

Risk in a project environment cannot be totally eliminated, but can be shaped and controlled by risk management. The main goal of a risk management process is to minimize the influence of some incidents that have not been planned on the project by identifying and addressing possible risks before negative consequences occur. Risk management process needs to be continuous and with high priority. This is important to the project success because it allows all team members to identify the top risks. Projects have complex nature in many fields, for example in the construction related field or in the software related field. That is why lots of unpredicted problems could be encountered during the project implementation, which results in exceeding budgets, fact that projects fall behind on deadlines, etc.

What can help managers to deal with problems before they occur? The answer is that by implementing methods of risk management, the project team will have greater control over the overall management of the project. Risk assessment, as the first of the two major risk management processes, includes identification, analysis and prioritization of risks. The second one is risk mitigation, which includes developing and monitoring strategies and residual risks. The result of great manager`s effort is a risk management plan that becomes a subset of the project management plan. A project manager needs to manage project risks and control them at the level that is acceptable for the project.

Every method of risk management has a specific area of application and can be used in order to cut down the risk element of a project to a minimum. Also, every method has the framework and is effective within a specific type of project. In different words, the method that could be the most appropriate for one project could be the most ineffective in another project. There are some methods that can be used as tools to minimize risk in software projects. It is important to emphasize the features, similarities and differences among these methods which consider many aspects while assessing and estimating the risks. Methods are different by their nature. It means that they explore different structures in the software development process, use different techniques and are applied over different phases in the development process. The process of risk management provides a structure to ensure visibility into risks and eventually to achieve project success.

Humans are included in developing, managing and using the software. Because of their education, experience, skills, motivation, working atmosphere or other personal reasons, they may commit different kinds of errors. These risk factors which are connected with the humans make it easier for us to understand the great importance that humans have and to realize the relevance of the human role. That is why risk assessment should take into consideration human factors involved in different processes in the software development, and not only to examination of these processes. Since people usually do not work alone, risk management methods need to include observation of the picture of cooperation in the process between different people, people and equipment, people and tasks, etc.

2. LITERATURE REVIEW

Schmidt *et al.* (2001) define risk factors as "a condition in which may be present a serious threat to the complete success of a software development project." Risk management can help project managers to anticipate delays that cause projects not to be delivered on time (Grant *et al.,* 2006). According to Dey *et al.* (2007), although some managers claim that they manage risks in their projects, there is evidence that they do not manage them systematically. Charette (2005) stated that the most common factors why software projects fail so often are: unrealistic goals, inaccurate estimates of necessary resources, badly defined system requirements, poor presentation of the project status and not managed risks.

According to Cervone (2006), project risk management is a necessary and critical task of the project manager and project team, where understanding risk management entails understanding the underlying factors that contribute to project risks. Boehm's (1991) results were quite significant as he identified the list of 10 software risk items and was the pioneer in developing methods for risk management in software industry. Berg (2010) stated that risk management is about making decisions that contribute to the achievement of an organization's objectives by applying them both at the individual activity level and in functional areas. According to Dey *et al.* (2007), managers often address technical risks, instead of dealing with market and financial risks, which are vital for a successful software development. Obviously, there is a need for integrated risk management. Berg (2010) stated that integrated risk management does not focus only on the minimization or mitigation of risks, but also supports activities that foster innovation, so that the greatest returns can be achieved with acceptable results, costs and risks. Ahmed *et al.* (2007) noted that unexpected events occur in projects and may result in either positive or negative outcomes that are a deviation from the project plan.

Dey *et al.* (2007) stated that frameworks suggested by other authors usually present problems from the clients` perspectives. Because of that, there is need for analysing the risk management issues in software development from the developers' perspective, with the involvement of the stakeholders, with the consideration of both qualitative and quantitative risk factors and integrating the risk management process with the software development cycle (project management). Cervone (2006) stated that by managing risks within a project, the project manager and team ensure that the project will be delivered on time and to the satisfaction of the end-user community. Berg (2010) noted that in order to apply risk management effectively, it is vital that a risk management culture be developed. The risk management culture supports the overall vision, mission and objectives of an organization. Cervone (2006) noted that project manager should record the results of risk assessments as well as the mitigation strategies for each of the risks pursued so that he could learn from the past.

3. RISK MANAGEMENT METHODS

3.1 BOEHM method

Barry Boehm was the pioneer in developing methods for risk management in software industry. In 1986. he developed the first risk-driven Spiral model (Boehm, 1986) by using the theory Win–Win model. Then, in 1991. he divided the process of risk management into two main phases: risk assessment and risk control (Boehm, 1991). Furthermore, risk assessment is divided into identification, analysis and prioritization and risk control is divided into planning, reduction and monitoring. The main aim of risk assessment part is to identify the underlying risks and assess the degree of risks and priority of risks. After that estimation, the risk control part has an important role in the whole management process, which includes risk management planning, risk reduction and risk monitoring. In the process of risk estimation and mitigation, it is more convenient to do analysis in the early stages of the software development process in order to encounter and overcome the problems in these early stages.

The Boehm method includes a set of principles and practices called the risk-analysis paradigm. It can be applied to software related projects for managing the risk of developing software. Basic concept in the model is risk exposure, which is defined by:

$$RE = P(UO) * L(U0) \qquad (1)$$

where RE is the risk exposure, P(U0) is the probability of an unsatisfactory outcome and L(U0) is the loss to the parties affected if the outcome is unsatisfactory. The valence of the risk event is defined by this.

According to the rating, a project has a relatively low (0.0 to 0.3), medium (0.4 to 0.6) or high (0.7 to 1.0) probability of some risk (Boehm, 1991).

Software projects involve several classes of participants (customer, developer, user and maintainer), each with different, but highly important satisfaction criteria, so the unsatisfactory outcome is multidimensional:

- For customers and developers, budget overruns and schedule slips are unsatisfactory.
- For users, products with the wrong functionality, user-interface shortfalls, performance shortfalls, or reliability shortfalls are unsatisfactory.
- For maintainers, poor-quality software is unsatisfactory (Boehm, 1991).

These components of an unsatisfactory outcome provide a checklist for identifying and assessing risk items. This model uses a decision tree method for identification the software risk items. It could be said that the goal of the risk management is to reduce the risk exposure associated with the software. This method can be used in all phases of software development process. Boehm identifies ten risk items and recommends risk management techniques to address them (Table 1).

Table 1: Boehm's top ten risk items (adapted from Boehm, 1991)

Risk item	Risk-management technique
Personnel shortfalls	Staffing with top talent, job matching, team building, key personnel agreements, cross training.
Unrealistic schedules and budgets	Detailed multisource cost and schedule estimation, design to cost, incremental development, software reuse, requirements scrubbing.
Developing the wrong functions and properties	Organization analysis, mission analysis, operations-concept formulation, user surveys and user participation, prototyping, early users' manuals, off-nominal performance analysis, quality-factor analysis.
Developing the wrong user interface	Prototyping, scenarios, task analysis, user participation.
Gold-plating	Requirements scrubbing, prototyping, cost-benefit analysis, designing to cost.
Continuing stream of requirements changes	High change threshold, information hiding, incremental development (deferring changes to later increments).
Shortfalls in externally furnished components	Benchmarking, inspections, reference checking, compatibility analysis.
Shortfalls in externally performed tasks	Reference checking, preaward audits, award-fee contracts, competitive design or prototyping, team-building.
Real-time performance shortfalls	Simulation, benchmarking, modeling, prototyping, instrumentation, tuning.
Straining computer-science capabilities	Technical analysis, cost-benefit analysis, prototyping, reference checking.

Managers can use the checklist on projects to identify and resolve risk items and the following set of risk-management techniques can be used in avoiding or resolving the source of risk. This is not only a method that covers all phases of software development project, which is its main advantage, but it is also a traditional and relatively simplistic method. On the other hand, its disadvantage lies in the fact that it doesn't handle generic risk implicitly. The Boehm method was the first method of risk management and risk items in the checklist sometimes are insufficient to cover the real situation because of continual changes in an unstable environment.

3.2 Riskit method

Jyrki Kontio, professor at the Helsinki University of Technology, proposed the Riskit method in 1996. The method has its focus on qualitative understanding of risks before their possible quantification. The method

was developed for software development projects and it is mainly applied in large organisations, though the method has some aspects of the business analysis that could be applied to any project in other areas (marketing, technology related business, etc).

Riskit method extends Boehm's approach by maintaining links between risks and stakeholders explicitly (Kontio *et al*, 1998). It is clear that every project has more than one stakeholder and they may have different priorities and levels of expectations. Therefore, risk management should be based on the recognition of their expectations and priorities.

When risk scenarios are defined, each risk can be described by its potential impact on project goals and each stakeholder can use this information to rank risks from their perspective. This allows full traceability between risks and goals (Kontio *et al*, 1998). In RISKIT method, a risk is defined more precisely, as a possibility of loss, the loss itself, or any characteristic, object or action that is associated with that possibility.

The method framework shows that method can be used for any software development project, but it fails to cover small to medium sized organisations. The main advantage of the method is flexibility, which means that it is originally developed for software development projects, but it can be applied to other areas (marketing, business planning, etc). On the other hand, a disadvantage is the fact that the method doesn't bridge the gap between risk estimation and risk metrics, which means that it is very difficult to predict the potential risk reliably.

The method`s main characteristics can be described by the following principles:

- The Riskit method provides precise and unambiguous definitions of risks;
- The Riskit method results in explicit definition of objectives, constraints and other drivers that influence the project;
- The Riskit method is aimed at modelling and documenting risks qualitatively;
- The Riskit method can use both ratio and ordinal scale risk ranking information to prioritize risks reliably;
- The Riskit method uses the concept of utility loss to rank the loss associated with risks;
- Different stakeholder perspectives are explicitly modelled in the Riskit method;
- The Riskit method has an operational definition and training support (Kontio *et al,* 1998).

Summaries of the activities in the Riskit process, as well as the main output of each activity are described in table 2.

Table 2: Overview of outputs and exit criteria of the Riskit process (Kontio *et al*, 1998).

Riskit step	**Description**	**Output**
Risk management mandate definition	Define the scope and frequency of risk management. Recognize all relevant stakeholders.	Risk management mandate: why, what, when, who, how, and for whom.
Goal review	Review the stated goals for the project, refine them and define implicit goals and constraints explicitly. Analyze stakeholders' associations with the goals.	Explicit goal definitions.
Risk identification	Identify potential threats to the project using multiple approaches.	A list of "raw" risks.
Risk analysis	Classify and consolidate risks. Complete risk scenarios for main risk events. Estimate risk effects for all risk scenarios.	Completed Riskit analysis graphs for all analyzed risks. Ranked risk scenarios.
Risk control planning	Select the most important risks for risk control planning. Propose risk controlling actions for most important risks. Select the risk controlling actions to be implemented.	Selected risk controlling actions.
Risk control	Implement the risk controlling actions.	Reduced risks.
Risk monitoring	Monitor the risk situation.	Risk status information.

Figure 1. presents flows of information among basic activities within the risk management cycle in a project: defining the scope and focus of risk management, review and definition of goals, risk identification and

monitoring, risk analysis, risk control planning and controlling of risks. Each activity can be performed several times during the project duration and they may be conducted concurrently.

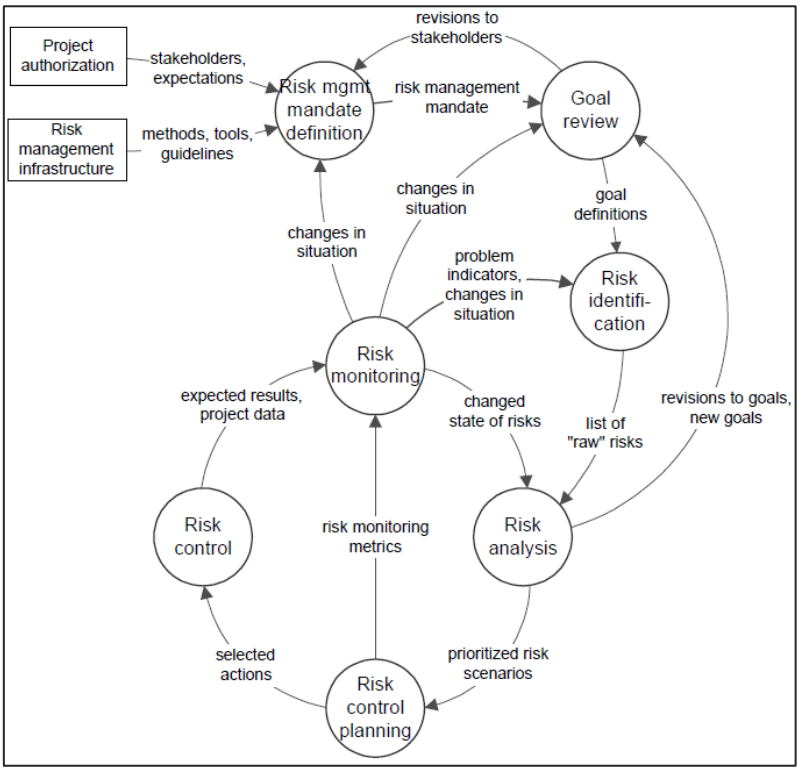

Figure 1: The Riskit risk management cycle (Kontio,1997).

3.3 Goal-driven Software Development Risk Management Model (GSRM)

The model was built with the goal of offering the solution how to integrate risk management activities into the project and it shows which techniques are needed to perform risk management activities. The authors stated that the literature fails to provide comprehensive and detailed guidelines on how to integrate risk management activities into the project at the early stages of development. Also, the practitioners should be acquainted with the impact of risk management practice on software projects (Islam *et al.,* 2014). Therefore, Goal-driven Software Development Risk Management Model was introduced as a goal-driven approach for risk management where risk management activities are integrated into early stages of project development. The model includes techniques identified as necessary to perform the risk management activities. Also, the results produced by the activities are precisely defined.

According to the authors, risk management is considered as an integral part of all organisational processes, including strategic planning and all project and change management processes. They have pointed out that the other risk management methods and frameworks include a number of limitations. Although the Boehms method made theoretical foundation of putting risk management into a single framework, a disadvantage is that this approach requires intensive active involvement of project customers/users, which is difficult to obtain in real on-going project. In spite of the fact that Boehm extended the original method to satisfy the objectives and concerns of the stakeholders, there is still a space for improvement. Also, the Riskit method has some important limitations, according to the authors of GSRM. They have agreed that this method provides a complete conceptual framework for risk management and precise and unambiguous definitions of risks. But, there are no clear sources specified from where the goals originate and how the identified goals are modelled. Also, risks are analysed by creating scenarios, which are always hard to create from factors, and it is difficult to make a comparison between them when a scenario depends upon more than one probabilistic element.

The GSRM adopted the risk management context considering internal and external organisational issues, risk management process and risk criteria from *ISO 31000:2009* standard (Islam *et al.,* 2014). The standard introduces guideline for implementing risk management into organisational processes using process, framework and principals and GSRM follows the guideline to define the risk management context within the

process. The framework of GSRM is an extension of the KAOS goal modelling language with concepts related to risk management (Islam *et al.,* 2014). The KAOS (Knowledge Acquisition in Automated Specification or Keep All Objectives Satisfied) method is a specific goal modelling method.

The framework, which is a layer based modelling framework, is comprised of four layers:

1. *Goal* (focuses on the factors that contribute to completion of the project activities and directly link to the project success),
2. *Obstacle* (identifies the potential software development risk factors and establishes the obstruction link from risk factors to sub-goals and from events to the main goal),
3. *Assessment* (quantifies the risk events as a consequence of single or multiple risk factors, establishes the causal relationship model between risk factors and related risk events);
4. *Treatment* (focuses on the control actions to counter the risks so that goals can be attained, monitors the effectiveness of the implemented control actions and identifies any new risks throughout the development).

Specific activities can be performed under any layer with appropriate tasks, methods and techniques in order to consider these components: project execution, development process, product, human, and internal and external environment. The main aim of this effort is to understand all the layers.

Layer based modelling allows usage of different techniques and methods across the layers which provides that the outcome can be transferred between the layers (Islam & Houmb, 2011).

Figure 2. introduces conceptual view of the model. According to it, goals and obstacles are derived from the development components, stakeholder expectations and project success indicators. And the main output is the goal-risk model.

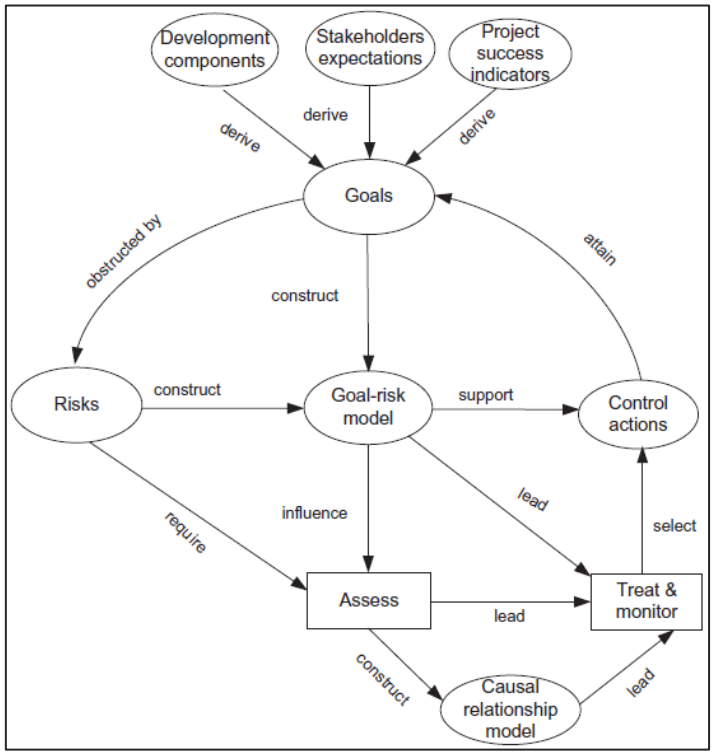

Figure 2: Conceptual view of the model (Islam *et al.,* 2014)

The model includes activities that involve all tasks required for goal-driven risk management:

1. Defining the risk management scope and boundary, schedule and resource allocation and composing a risk management team so the risk management plan could be initialised.
2. Identifying and modelling goals by focusing on the state of the development components and matching them with the project.
3. Identifying and modelling obstacles (as many obstacles as possible so the team is aware of problems from the beginning).
4. Risk assessing by estimating risk level and relevant priority.

5. Risk controlling as early as possible and monitoring the effectiveness of the control action throughout the project.

The requirements engineering phase is an early stage of the project development and includes risk management activities such as formulating goals, capabilities, constraints, system vision and requirements. Since requirements engineering and software risk management process are two different processes, it is important to emphasize that activities of the requirements engineering and risk management process are sequential and techniques used within the activities are similar. The GSRM model provides three techniques to identify and analyze goals and risks: structured interviews with closed questions, brainstorming sessions, analysis of project documents. For example, information gained from the project brainstorming session was verified during the interview session. The integration of risk management into requirements engineering provides early warnings about issues existing in the project (Islam *et al.,* 2014).

The requirement engineer`s role includes activities such as creating and managing the requirement specification by aligning the business needs to the software, establishing the bridge among business analyst, architect, project manager, and customer/user. A risk manager is a person who should have necessary knowledge about managing the project and skills to handle risks in a different project situation. Responsibilities of a risk manager include performing risk assessment and management activities.

4. METHODS REVIEW

Boehm made the theoretical foundation for project risk management with the risk-driven Spiral model, and identified ten risk items with recommendation of appropriate risk management techniques. Later Boehm extended original model in order to satisfy the objectives and concerns of the stakeholders by using the theory Win–Win model. This is a method that covers all phases of software development project, which is its main advantage, and also a traditional and relatively simplistic method. Although the Boehms method made theoretical foundation of putting risk management into a single framework, a disadvantage is that this approach requires intensive involvement of project customers/users, which is difficult to obtain in real on-going project. Managers can use the checklist on a project to identify and resolve risk items and the following set of risk-management techniques can be used in avoiding or resolving the risk source. The Boehm method was the first method of project risk management and risk items in the checklist sometimes are insufficient to cover the real situation because of continual changes in an unstable environment. Also, a disadvantage is the fact that it doesn't handle generic risk implicitly.

The Riskit method extends Boehm's approach by maintaining links between risks and stakeholders explicitly. Risk management should be based on the recognition of stakeholder`s expectations and priorities because they may have different priorities and levels of expectations. Main advantage of the method is flexibility, which means that it is originally developed for software development projects, but can be applied in other areas (marketing, business planning, etc).

The Riskit method framework shows that method can be used for any software development project, but it fails to cover small to medium sized organisations. On the other hand, a disadvantage is the fact that the method doesn't bridge the gap between risk estimation and risk metrics, which means that it is very difficult to predict the potential risk reliably. Although Kontio's Riskit is a goal-driven approach, it is not clear from where goals can originate and the risk analysis is based on scenarios which are difficult to formulate.

And while the Boehm`s method doesn't handle generic risk implicitly, Goal-driven Software Development Risk Management Model supports identification of both project specific and generic risks that need adequate treatment. This model was introduced as a goal-driven approach for risk management where risk management activities are integrated into early stages of project development and relation between project goals and risks that may obstruct these goals is established. That is the best way for selecting the adequate actions to prevent project risks because project goals need to be fulfilled in order to obtain a successful project.

The model was built with the aim of offering the solution how to integrate risk management activities into the project and it shows which techniques are needed to perform risk management activities. The approach requires intensive and active involvement of project customers/users, which is difficult to attain in real on-going project situations. This goal-driven approach is appropriate for project risk management that is well integrated into the early requirements engineering stage.

5. CONCLUSION

Software industry uses knowledge as a resource and many activities are knowledge intensive. There is the need for organizations not only to improve their ability to identify, but also to manage the risks associated with software development projects. Many factors, such as inaccurate estimation of needed resources, badly defined system requirements, unrealistic or unarticulated project goals, risks not managed, etc, need early consideration in the project development stage because of direct or indirect influence on project success.

Different authors proposed different approaches, methods and models for dealing with project risks, with variety of techniques for accomplishing the process of identifying and estimating risks in a project. There is a need for more flexible approaches to risk management which allow taking advantage of new techniques. Risk assessment is often performed once at the project development stage and then never again during the project's lifetime. The truth is that risk assessment should be revisited and risk management plan should be revised whenever something new and important about products and processes is learned.

Among many project risk management approaches, methods and models, the paper considers the Boehm method, the Riskit method and the Goal-driven Software Development Risk Management Model. The Boehm method was the first project risk management method and therefore made the theoretical foundation for project risk management. The Riskit method includes some extensions of Boehm's approach related to stakeholders involvement. Although Riskit is a goal-driven approach, it is not clear from where goals can originate. This is improved with another goal-driven approach that focuses on the factors contributing to completion of project activities and are directly linked to the project success. Because of the lack of literature with comprehensive and detailed guidelines on how to integrate risk management activities into the project at the early stages of development, the GSRM was built. The model includes activities that involve all tasks required for goal-driven risk management.

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DEFINING "SUCCESS" FOR PROJECT MANAGEMENT INFORMATION SYSTEM: A CROSS SECTIONAL STUDY

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Abstract: *This paper presents the impact of project management modules on the project information systems implementation and its success. Project management modules, which are taken into consideration, are: Demand management, Portfolio selection and analytics, Resource management, Schedule management, Financial management, Time and task management, Team collaboration, Issues and risk management, Business intelligence and reporting, Portfolio and program management. The research was conducted among 51 project portfolio managers in Serbia. Research results show different perception for Business intelligence and Portfolio selection and analytics modules implementation among project managers in profit, non-profit and public sector.*

Keywords*: Project, success, information system, modules.*

1. INTRODUCTION

Projects usually have a wide variety of objectives and limitations, involving numerous internal and external actors, and are conducted in various activity sectors. Since 1980, many academics and practitioners have agreed that project management software development is one of the most crucial elements of an organization"s success. Modern university curricula in software engineering and project management include broad categories in knowledge-based training from one point of view, and from the other point of view also the acquisition of practical skills or the ability to apply the knowledge to practical situations and problem-solving using initiative, autonomy and creativity. Thus, engineering education in general and software engineering in particular is becoming increasingly complex and requires an integrated approach to practice and non-technical skills, specifically oriented to technical competences.

Therefore, practical implementation includes project planning and control and resource allocation are widely used to create real problems and implementation procedures in the context of project management software. In accordance with the above mentioned, most of the university courses about Software Project Management contain topics about Project Management body of knowledge, planning, scheduling and control and the most widely used software for practical classes (for example Microsoft-Project and Share Point services which are related with web based approach) (Salas-Morera et al., 2013).

In this paper we discuss about software project management module application in context of project success. A positive relationship between project performance and software process standardization is expected based upon management control theory. Managerial control refers to an organization"s attempt to influence employees to behave in accordance with standardized procedures and formal rules. Most documented reports are case studies that experienced a positive relationship between software process improvement and project cost reduction. Nevertheless, some researchers have argued that the management of the project"s scope, schedule, staffing, and other resources is tied to a defined process (Liu et al., 2008).

The mediator role of software flexibility implies that software engineering needs to focus effort on software flexibility as well as standardization. Software flexibility and adaptability to company business needs does impact final project performance. Information systems project managers should not regard software flexibility as an irrelevant issue. The total software quality and stability (e.g., software features and software response time) may indeed increase the overall project cost and require additional time, as argued in some project management textbooks. In this study, however, the result indicated that software flexibility might have a positive, instead of a negative, impact. Different software development guidelines and methodologies exist to enhance software flexibility. Management must choose methodologies and approaches to enforce this quality.

2. PROJECT MANAGEMENT SOFTWARE MODULES

2.1. Demand management

Using the Demand Control Support model as conceptual framework and framework for demand creation, Pintoet al. (2014) analyzed a sample of respondents from four project intensive organizations. Their findings demonstrate that women tend to experience emotional exhaustion to a greater extent than their male counterparts. In construction industry specific attention should be given to how the need to work long hours is justified. Organizations should look to improve managerial and collegial support for construction professionals, but be careful in engaging in socializing and project team-building activities (Bowen et al., 2014). Demand management capabilities this module helps organizations accomplish the following objectives:

- Integrates project proposals, portfolio analysis, and project management
- Captures all work proposals in one place
- Guides the proposals through a multistage governance process
- Helps users make decisions about which proposals to approve
- Tracks progress on project execution until the work is completed

2.2. Portfolio selection and analytics

When project portfolio management offices act as project portfolio managers their activity patterns include handling the challenges of project portfolio management and performing characteristic managerial tasks in project portfolio management. By quantitatively analyzing project portfolio management offices in 278 portfolios, Unger et al. (2012) identify three different activity patterns, which are interpreted as distinctive roles. They highlighted a significant positive correlation of project portfolio management offices" analyzing roles on performance in terms of project portfolio management quality that is a predictor of project portfolio success. Considering different stages of the R&D project portfolio selection process a multi-stage decision framework was proposed by Abbassi et al. (2014).

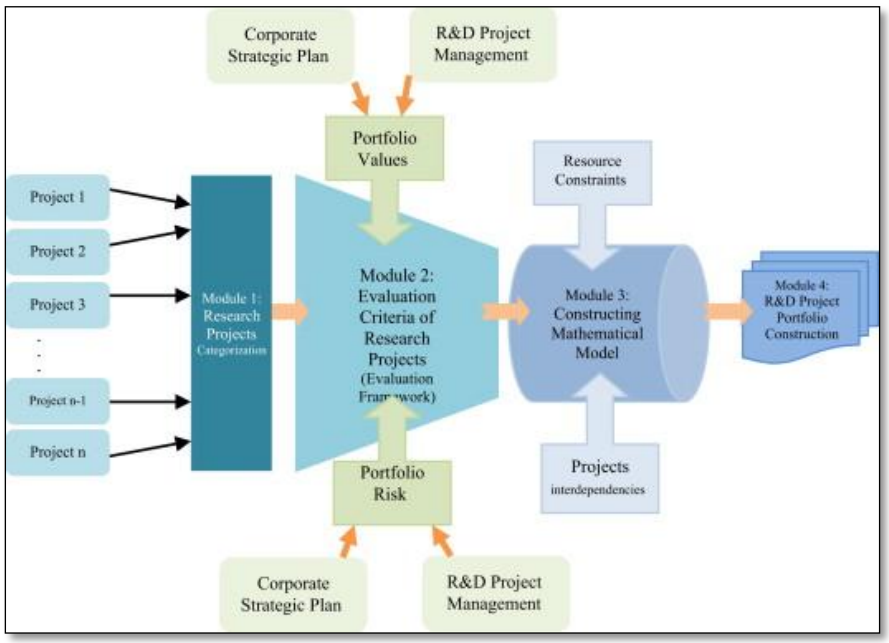

Figure 1: Multistage decision framework for R&D projects (Abbassi et al., 2014)

Adopting structured portfolio selection processes and techniques this module helps organizations accomplish the following:

- Define, communicate, and prioritize business strategy
- Score and assess competing requests from multiple dimensions
- Run what-if analysis optimization scenarios under various budgetary constraints
- Compare and contrast portfolios and gain insight through advanced analysis such as Efficient Frontier modeling

- Assess capacity and adjust project schedules to maximize resource utilization across the planning horizon
- Run and model headcount scenarios

2.3. Resource management

The objective for resource management module is to minimize the project make-span as well as the penalty cost when some projects carry higher priority. Thus, resource center is the crucial part of web based project management software. Since the problem is hard in terms of resource over location, Singh (2014) solve this problem by integrating the project priority with the activity priority, using a hybrid algorithm based on priority rules and analytic hierarchy process. On the other hand, (Obradovic et al., 2014) emphasize technical competences as a key indicator for project success according to IPMA Competence baseline. Adopting best-practice resource management techniques this module helps organizations accomplish the following:

- Consistent definition of resources - resource pool
- Assess resource availability across multiple projects - resource capacity
- Ability to “drill down” to view resource utilization

2.4. Schedule management

Whilst capturing resources can ensure that a tardy but „business-critical“ project is delivered on time, if the organization has no free resource capacity and is also not recruiting more staff, this practice harms the schedule performance of the projects deprived from resources (Yaghootkar and Gil, 2012). Adopting best-practice scheduling methodologies and tools dopting best-practice methodologies this module helps organizations accomplish the following: helps organizations achieve the following:

- Create and update schedules from the desktop or online
- Effectively control and analyze schedules
- Easily communicate schedule information

2.5. Financial management

Halawa et al. (2013) indicates that there are various methods of financial appraisal and evaluations in the investment field. The first one is called “discounting methods”, including net present value and internal rate of return; the second one is called “simple methods”, including payback period and simple rate of return; the third one is called “financial evaluation under uncertainty” and this includes break even analysis and sensitivity analysis. Key challenges that organizations face when trying to improve their financial management processes include the following:

- Standardizing cost and benefit estimates
- Project accounting and change management
- Financial visibility and insights
- Integration with LOB (line of business) systems

2.6. Time and task management

A study by the Standish Group scanned more than 8000 projects and compared their anticipated results with the real outcome. According to this study, only 16% of the projects were able to meet the goals set in terms of time, budget and quality (Hameri and Heikkilä, 2002). Time captures and project progress reporting poses several challenges to organizations, and they need to have the following characteristics:

- Time capture and project progress reporting
- Report working and nonworking time
- Capture projects, operations, and administrative time
- Recurring time periods
- Integrate with LOB systems

2.7. Team collaboration

An increasing number of companies, especially those with knowledge-intensive R&D programs, have turned to virtual project teams in recent years to generate the greatest competitive advantage from limited labor and resources. The empirical results, from a study on a sample of 75 project team members who were making full use of collaborative technologies in their project work context, not only confirmed technology acceptance model, but also demonstrate that the nature of the performed tasks positively influence perceived benefits

and user attitudes towards the use of collaboration technologies in project teams. Users with a high intention to adopt a collaboration technology in their work context, showed increased performance in decision-making or problem solving (Nikas and Argyropoulou, 2014). Effective collaboration techniques within their project portfolio management processes have following characteristics:

- Provide a central location for team collaboration
- Effectively manage a variety of content
- Simplify and enhance team communication

2.8. Issues and risk management

Sanchez et al. (2008) introduce a framework to identify risks and issues during project portfolio risk management process that helps to decrease the uncertainty of achieving the strategic goals of the organization. The final output of the framework is a portfolio risk-opportunity register, which highlights the potential events that could impact the achievement of the goals. Adopting best-practice methodologies this module helps organizations accomplish the following:

- Define a standard way to assess risk for new initiatives
- Standardize project risk collection and management
- Establish proper issue resolution and escalation

2.9. Business intelligence and reporting

Business intelligence module consists of business users and applications accessing data from the data warehouse to perform enterprise reporting, OLAP, querying, and predictive analytics. Most organizations create custom reports based according to the following factors: type of project, level of maturity, number of projects, number of employees, etc. Adopting best-practice methodologies this module helps organizations accomplish the following:

- Standard metrics for measuring performance
- Create Reports and Build Powerful Dashboards
- Create Sophisticated Reports

2.10. Portfolio and program management

Project portfolio selection is the periodic activity involved in selecting a portfolio of projects, that meets an organization"s stated objectives without exceeding available resources or violating other constraints. Some of the issues that have to be addressed in this process are the organization"s objectives and priorities, financial benefits, intangible benefits, availability of resources, and risk level of the project portfolio. Optimal portfolio selection is a major stage in the framework. Adopting best-practice methodologies this module helps organizations accomplish the following:

- Capture, Prioritize, and Select Programs
- Clarifying program and project controls to improve efficiency
- Program Delivery

3. EMPIRICAL RESEARCH

3.1. Research method and sample description

Data collection tool was questionnaire consisted of both independent and dependent variables. Independent variables were personal data of respondents: information about sex, work experience, education and position in organizational hierarchy. Dependent variables were data related to web module in organizations, obtained from the questionnaire consisted of 19 questions that offered answers evaluation from 1 (without influence) to 5 (very high influence). Representative sample consisted of 51 project managers from companies in various sectors – profit (82%), nonprofit (8%) and public sector (10%). Structure of respondent"s position in organizational hierarchy was the following: 33% from executive management level, 16% from operational management level and 51% from middle management level. Also, the sample consists of 60% males, and 40% females.

3.2. RESEARCH RESULTS AND DISCUSSION

Financial Management module is the highest ranked with score of 3.94, and the lowest is Portfolio Selection and Analytics module with score of 3.24. Beside the average value for Portfolio Selection Analytics module, only Business Intelligence module also has the average value below the total average value of all modules.

Portfolio Selection and Analytics and Business Intelligence and Reporting modules have the highest standard deviation (table 1). The key reason is that employees don"t know or don"t understand the usage of these two modules in organizations.

Table 1. Influences of the project management web modules on project management success

Project Management Modules	Average	Standard Deviation	Variance
Project and Resource Center	3.71	0.78	0.61
Time and Schedule Management	3.78	1.01	1.01
Financial Management	3.94	0.76	0.58
Business Intelligence and Reporting	3.29	1.19	1.41
Collaboration	3.78	0.88	0.77
Portfolio Selection and Analytics	3.24	1.19	1.42
Risk Management	3.65	0.87	0.75

Dominant results are indicative for Public sector (table 2). For Public sector highest value is related with time and schedule management, which means that employees in public sector appreciate most the time, but on the other hand conclusion for this module can be related that working time is different according to sector, and with many others criteria (e.g. conditions, job security, advancement, growth, power, affiliation, esteem, decision-making processes, rewarding systems, task-related rules as well as social rules, like punctuality in task completion, agreed time to read and respond to messages, respect of consensus decisions, honesty, truth, preparation for and attendance to meetings, punctuality on meetings, etc).

Also, Business Intelligence and Reporting module in Public Sector has the lowest value, which could be consequentially related with time management and critical success factors (table 3). The implementation of business intelligence and reporting does not always result in expected outcomes. This problem, called paradox of productivity (delays in the observation of an increase of productivity, poor management of business intelligence and reporting, poor qualified workforce, or the difficulty to estimate, by means of an accounting treatment, the result (profit/loss) of an investment in Business Intelligence and Reporting. Raffo, (2005) emphasize „forward-looking" decision support framework that integrates up-to-date metrics data with simulation models of the software development process in order to support the software project management control function, considering the focus on the overall decision framework using outcome based control limits, utility functions and financial performance measures (e.g. return on investment, net present value, break even point and others) which is new.

Table 2. The average value of responses regarding to the Influence of the various web modules on project management success by sectors

Influences of the various web modules on project management success:	Public Sector	Non-profit Sector	Profit Sector
Project and Resource Center	3.2	3.75	3.76
Time and Schedule Management	4.2	3.5	3.76
Financial Management	4	3.25	4
Business Intelligence and Reporting	2.4	4	3.33
Collaboration	3.4	3.75	3.83
Portfolio Selection and Analytics	3.6	3.75	3.14
Risk Management	3.4	3.75	3.67

Table 3. The average value of critical success factors and the average value of influences of the various web modules on project management success

	How often are critical success factors defined in the projects via web platform?	Influences of the various web modules on project management success
Public Sector	4	3.46
Non-profit Sector	4.25	3.68
Profit Sector	4.64	3.64

Project management software packages generally facilitate the integration of project data, the interaction with enterprise systems and the interoperability with business intelligence and reporting systems. Besides optimizing the productivity of the teams, the system allows to make better decisions, to maintain a competitive advantage and to implement an effective project management. This type of software consists of subsystems developed to treat various aspects of project management: procurement, construction, cost control and analysis, planning, quality insurance, etc.

4. CONCLUSION

Successful project management information system implementation in organizations depends on the following criteria: business process definition, maturity level of the company, number of employees, budget, number of projects, number of specific requests, etc. Difference between profit, non-profit organizations and organizations in public sector about project management system implementation could be noted in two modules - Portfolio Selection and Analytics and Business Intelligence and Reporting modules. Future consideration will include agile methodology and its application on software projects. Clients are seen to have matured in their understanding of IT projects, because maturity reveals itself in a greater understanding of the complex issues that confront IT projects and, therefore, a deep skepticism about the ability of IT departments and suppliers alone to deliver value.

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RISK INDEX AS PROJECT RISK MEASURE

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Abstract: *This paper analyzes project risk, as risk has been viewed in recent years as a dimension of a project at the same level as the scope, time, and cost. The paper provides a definition of risk index as a model for assessing the project impact of various risk factors. Determination of risk index is presented through the example of construction projects. The results show that political factors are the dominant macro-level risk factors, whereas design factors prevail at the micro level.*

Keywords: *management, project, risk, risk factor, risk index*

1. INTRODUCTION

It has long been thought that a project has three dimensions: cost, time, and scope. However, in recent times, a fourth dimension – risk – has been added (Bobera, 2003). Project risk is an uncertain event or condition which, if it does occur, has either a positive or a negative effect on at least one of the project attributes, such as time, cost, scope, or quality (Project Management Institute [PMI], 2004). Therefore, it is necessary to manage project risk.

In the past decade, there has been a significant increase in the body of published work on project risk management. In her analysis of papers pertaining to project risk, published between 2000 and 2012 in four representative risk management journals, Liisa Lehtiranta (2014) found that 70% of the research deals with construction project risk, 19% with IT and software project risk, and only 11% with risks in other industrial projects and projects in general (645).

This paper: (1) lists the basic project risk causes or factors; (2) analyzes the process of project risk management; (3) defines risk index; (4) describes the method for determining the significance of risk factors and their potential impact; and (5) presents risk index determination using the example of a construction project.

2. PROJECT RISK MANAGEMENT

Project risk management is an organized process of risk identification and measurement, as well as selection, development, and implementation of risk control and monitoring options (Kerzner, 2004). Project risk management contributes to higher probability of a successful project realization – understanding of potential problems and their influence on project realization requires that activities be undertaken which will reduce a potential harmful impact of specific events on the project. This entails certain costs, which is why risk management is considered an investment. Risk management should be invested in, while observing the rule that the costs of risk must not exceed the potential benefits.

2.1. Basic project risk causes

Project management differs from management of any other process. The fact that a project has to solve an unknown problem suggests that project risk is higher than risk in other processes. The majority of risks are directly associated with a project and the activities aimed at its realization. Nevertheless, there are also indirect risks, which are the result of altered business environment of organizations.

Direct project risk causes include the following (Zayed & Chang, 2002, Nouks, 2005, Gohar, Khanzadi, & Farmani, 2012):

- Possibility that the project result will not meet the expectations;
- Refusal of project results by the users;
- Discrepancy between the required and the available resources;
- Increased project costs;
- Prolonged project duration;
- Lack of team members" experience with realization of similar projects;

- Deficiencies in technology for project realization;
- Imprecisely defined tasks;
- Inadequate software support;
- Insufficient project quality;
- Project changes;
- Insufficient safety;
- Inadequate team members‟ knowledge and skills;
- Task complexity;
- Inadequate management support.

Indirect project risk causes associated with business environment include the following (Zayed & Chang, 2002, Noks, 2005, Gohar, Khanzadi, & Farmani, 2012):
- Market changes;
- Market range and competitiveness;
- New investment options;
- Regulatory and legislative limitations;
- Erroneous market assessment;
- Inflation;
- Lack of available funds;
- Public opinion of the company brand.

Causes of task risks are task specific and can be identified and understood if each task is analyzed separately.

2.2. Project risk management processes

Even though there are many ways to structure risk management, project risk management usually involves the following six stages (PMI, 2004): 1) risk management planning, 2) risk identification, 3) qualitative risk analysis, 4) quantitative risk analysis, 5) risk response planning, and 6) risk control and monitoring.

Risk management planning is the process of developing and documenting an organized, comprehensive, and interactive risk management strategy; defining methods for risk identification and analysis; selecting, developing, and implementing risk treatment options; and planning proper resources (Kerzner, 2004). A risk management plan is a document which contains project risk management procedures during the project‟s life cycle and which summarizes the results of risk identification and assessment, response planning, and risk adjustment and control. Risk management plan can also contain risk management methodology, roles and responsibilities for risk-related activities, budget and activity schedule, description and interpretation of risk analysis methods, risk ranking criteria, type of reporting risk management activities, and the manner of monitoring those activities (Bobera, 2003). In addition to the basic plan, the following can also be defined: (1) operation plans – plans for activities conducted in case of a specific and identified risk event; (2) retreat plans – plans devised for risks which heavily impact project goals and which are activated in case a previously planned risk reduction does not produce the expected results; (3) operational reserves – additional means to be used for risk mitigation if there are changes in project scope and quality.

Risk identification implies the establishment and understanding of potential unsatisfactory project results in terms of project nature and goals, scope, time, cost, and quality. It is performed in order to create a list of risk sources and factors, as well as events which can affect goal accomplishment. Such events can disable, reduce, increase, or postpone the realization of defined goals. As the identified events can occur in a variety of ways, it is necessary to devise different scenarios for the events. Most commonly, these are basic scenarios as the most probable risk event scenarios. International standard ISO/IEC 31010 (2009) recommends using the following methods and techniques to identify project risks: brainstorming, survey, interview, checklist, preliminary hazard list, hazard and operability study, „what-if‟ analysis, scenario analysis, cause-and-effect analysis, and probability and impact matrix.

Risk analysis involves the description of identified risks, extraction of the causes, and analysis of how they influence risk (taking into consideration the existing processes, devices, or practice by which a given risk is controlled), assessment of risk occurrence probability and impact, assessment and quantification of risks, creation of priority risk list, proposals of risk response methods, and definition of parameters and metrics for risk monitoring (Savic, Stankovic, 2012). Risk assessment is performed through unified assessments of probability and impact for every risk scenario. Extensive information on the frequency and impact of hazards should be integrated and presented in a relatively simple form for easier understanding and decision making. This could be a unique numerical index, a table, a matrix, a graph, or a risk chart.

Risk analysis can be qualitative, semi-quantitative (qualitative-quantitative), quantitative, and combined. Qualitative and semi-quantitative risk analysis typically includes the following methods and techniques: survey, SWOT analysis, cause-and-effect diagram, expert assessment, the Delphi technique, preliminary hazard analysis, fault tree analysis, failure mode and effects analysis, probability and impact matrix, and multi-criteria analysis. Quantitative risk analysis typically includes the following methods and techniques: probability theory, mathematical statistics, operational research, sensitivity analysis of effectiveness indicators, scenario analysis, fault tree analysis, event tree analysis, Monte Carlo methods, and modelling and simulation methods (ISO 31010, 2009).

In order to properly utilize a risk assessment (for selecting technical and managing actions and for establishing a connection with social and administrative bodies), it is essential to know the degree of indeterminacy of the assessment. Indeterminacy of the assessment depends on the quality of the database, models, and methods of analysis used. Data indeterminacy stems from the fact that an insufficient range of real data is appended with expert assessments or opinions. Such indeterminacies can be mathematically analyzed and quantified. Model indeterminacy is always present due to partial compatibility between the real system and its model. The indeterminacies are difficult to quantify, and they are more precisely determined by sensitivity analysis.

Sensitivity of results towards a model parameter is defined as the change of risk measure with the change of unit parameter. This analysis is performed for all parameters which are assumed or known to have a high degree of indeterminacy. A model parameter with the highest influence on risk also has the highest sensitivity. The effect of indeterminacy can be reduced by means of relative risk assessment. If one and the same methodology is used to assess different alternatives, the resulting risk assessment is subject to the same indeterminacy. Thus, ranking of various alternatives provides a better risk assessment than the absolute assessment.

Use of quantitative risk assessments in practice requires risk classification. The primary problem here is the decision on risk acceptability. The decision on which risk can be considered acceptable often depends on a company"s economic capabilities. Categorization of acceptable risks is a result of expert assessment, in accordance with the framework, content, and goals of the project. In addition to ranking and evaluating risks, risk factors can also be ranked, considering their impact on project risk. Such a list indicates the most important factors of potential risks and, accordingly, the points and paths in which risk reduction measures would be the most effective.

Risk categorization is the foundation of risk response planning. Risk treatment defines activities which expand the possibilities and reduce threats to project goals. The basic risk response planning options are the following: risk avoidance (elimination of uncertainties and high risks); risk reduction (preventive reduction of potential risks); risk retention (voluntary acceptance of risk and keeping it at an acceptable level); and risk transfer (distribution or transfer of risk to other organizations, agencies, or associations).

Risk monitoring is a continual process of monitoring and assessing risk management processes by means of measuring and reporting, as well as through feedback, which initiates re-planning, reassessment, and/or management response ("*Systems Engineering Fundamentals*", 2001)

3. RISK INDEX

Risk index (R) is a model designed to assess the potential impact of various risk factors on a project. It was originally developed by Dias and Ioannou (1995) and modified by Zayed and Chang (2002). The model represents a logical, reliable, and consistent method of risk factor ranking, project evaluation, and establishment of project priorities based on risk index value.

Risk index is a function of two parameters. The first parameter pertains to risk factor or subfactor weight, and the second to the impact of the observed risk factor or subfactor on project goals. Risk index is determined separately at the macro level (management level, where environmental risks are considered) and the micro level (the level of the project itself, where immediate project risks are considered). The total risk index is the product of risk indices for the macro and micro levels of the project.

According to Zayed and Chang (2002) and Zayed, Amer and Pan (2008), risk index at specific levels is determined by equation (1):

$$R_k = \sum_{i=1}^{n} w_i E_i \,, \qquad (1)$$

where:

R_k - risk index at k^{th} level (k=1 at the macro level and k=2 at the micro level),

w_i - weight of the i^{th} risk factor/subfactor determined by the eigenvalue method,

E_i - impact value of the i^{th} risk factor/subfactor,

n - number of risk factors/subfactors.

The total risk index is calculated by equation (2):

$$R = R_1 R_2 . \quad (2)$$

3.1. Weighting

The Analytic Hierarchy Process (AHP) method is used for weighting by the eigenvalue method.

AHP was developed by Thomas L. Saaty in the 1970s. AHP provides a flexible and easily understood way to analyze and parse the decision problem. It is a multi-criteria decision-making methodology that allows subjective and objective factors to be considered in the evaluation process.

AHP method involves the following steps: (1) identification and clear definition of the overall goal (objective); (2) identification of the criteria, sub-criteria, and alternatives which satisfy the overall goal; (3) formation of the hierarchical structure; (4) performance of pairwise comparisons; (5) determination of weights of the decision elements by means of the eigenvalue method; (6) verification of the consistency of results; and (7) determination of the global priority vector.

Goal identification. The goal is to determine weights of risk project factors/subfactors.

Identification of criteria, sub-criteria, and alternatives. Risk factors are identified as criteria (e.g. at the macro level, these include policies, finances, and the market, while at the micro level – technology, resources, organization, project performance, etc.). Risk subfactors are identified as sub-criteria or alternatives (e.g. within policies, these include change in government policy or national legislation, within finances – inflation, interest rate or risk fund changes, or within technology – material risk, equipment risk, change in technology, etc.). If risk index is determined for several projects, the projects then represent alternatives.

Hierarchical structure formation. The Fuzzy AHP method presents a problem in the form of hierarchy: the first level represents the goal; the second level considers relevant criteria; the third level considers relevant sub-criteria; and the last level defines alternatives.

Pairwise comparison. Once the hierarchy has been constructed, the decision-maker determines the relative importance of the elements at each level of the hierarchy. Elements at each level are paired, taking into account their relative contribution to the elements at the first higher hierarchical level, using the 1-9 Saaty"s comparison scale, where 1 means that importance of two criteria is the same, while 9 means that one criterion is extremely more important than the other. For each level, starting from the top of the hierarchy and going down, the pairwise comparisons are reduced in the square matrix form: $A = \left[a_{ij}\right]_{i,j=\overline{1,n}}$, where $a_{ij} = 1$ for *i=j* and $a_{ij} = 1/a_{ji}$.

Determination of relative weights. The mathematical basis for determining weights based on matrix theory has been proposed by Saaty (1980). The procedure is called an eigenvector approach, which takes advantage of the characteristics of a special type of matrix called a reciprocal matrix. The eigenvector $W = (w_1, w_2, ..., w_n)$ can be generated in different ways. The two most frequently used methods – arithmetic mean method and geometric mean method – follow below.

In the arithmetic mean method, the elements of the eigenvector are calculated as follows:

$$w_i = \frac{1}{n}\sum_{j=1}^{n}\frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}}, \quad i = 1,2,...n . \quad (3)$$

In the geometric mean method, the elements of the eigenvector are calculated as follows:

$$w_i = \frac{\left(\prod_{j=1}^{n} a_{ij}\right)^{\frac{1}{n}}}{\sum_{k=1}^{n}\left(\prod_{j=1}^{n} a_{kj}\right)^{\frac{1}{n}}}, \quad i = 1,2,...,n. \qquad (4)$$

Checking results consistency. Consistency implies that the decision-making procedure involves coherent judgments in specifying the pairwise comparison of the criteria, sub-criteria, or alternatives. Consistency is determined by the consistency ratio, as given in equation (5):

$$CR = \frac{1}{RI}\left(\frac{\lambda_{\max} - n}{n-1}\right), \qquad (5)$$

where RI is a random index (Table 1), n is the number of pairwise comparison elements in matrix A, and $\lambda_{\max}$ is calculated as follows:

$$\lambda_{\max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{w_i}. \qquad (6)$$

Table 1: Random indices (Saaty, 1980)

n	1	2	3	4	5	6	7	8
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40

If a consistency ratio is 0.10 or less, it can be considered acceptable; otherwise, the judgments should be improved. This improvement should be made by double-checking the data entry and by omitting bad judgments which have high inconsistency ratios (Saaty, 1980).

Global priority determination. The final stage involves finding a vector of global priority. Since the successive levels of hierarchy are linked together, a global weight vector for the entire hierarchy is determined by multiplying the weight of all vectors of successive levels.

3.2. Impact assessment

The impact of the i^{th} risk factor/subfactor E_i reflects the level of project performance change in relation to that risk factor/subfactor. It is determined through the following two steps: (1) first, the qualitative impact of risk factor/subfactor at project performance level has to be determined by means of the 1-9 scale, shown in Table 2; (2) then, the qualitatively expressed risk impact has to be quantified in a 0-100 point value range, or 0-1 range, as shown in Figure 1.

Table 2: Qualitative performance scale (adapted from Zayed and Chang, 2002)

Qualitative performance scale	Abbreviation	Equivavelt numerical index
Extremaly Undesirable	ExU	1
Substantialy Undesirable	SuU	2
Moderately Undesirable	MoU	3
Slightly Unesirable	SiU	4
Neither Desirable nor Undesirable	Nei	5
Slightly Desirable	SiD	6
Moderately Desirable	MoD	7
Substantialy Desirable	SuD	8
Extremaly Desirable	ExD	9

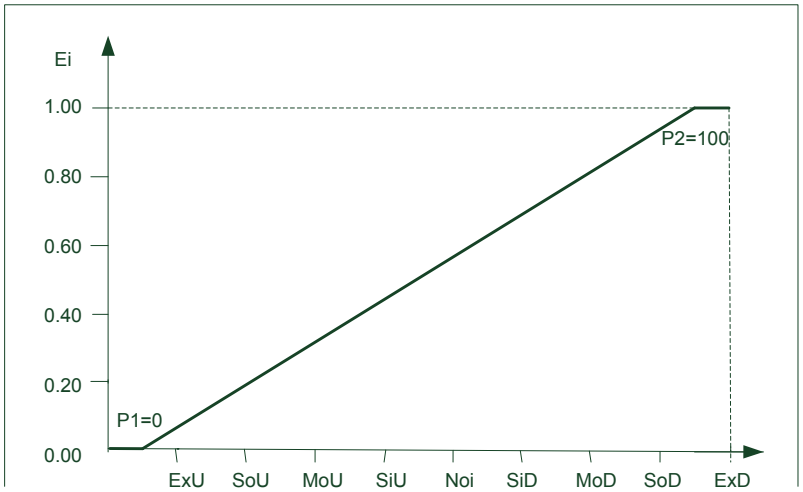

Figure 1: Quantitative performance scale (Zayed and Chang, 2002, p.12)

In Figure 1, there are three areas of risk impact. The first area is the area of acceptable risk impact, which indicates a maximum performance level (P1=0 points, or E=0); the second area is the area of linear growth of risk impact (0<P<100, 0<E<1); and the third area is the area of the highest risk impact and a minimum performance level (P2=100 points, or E=1).

3.3. Ranking

Risk factors/subfactors are ranked based on risk index values for each factor/subfactor. The factor/subfactor with a highest risk index value has the biggest impact on project quality. At the same time, risk index indicates priority actions for project risk reduction.

Based on macro, micro and total risk index values, projects can be categorized as shown in Table 3.

Table 3: Project risk categorization based on risk index

Risk index on the macro and at the micro levels	Total project risk index	Risk categorization
≤ 0.2	≤ 0.04	Low risk
< 0.2 *and* > 0.6	< 0.36 *and* > 0.04	Medium risk
≥ 0.6	≥ 0.36	High risk

The total project risk index is also the basis for ranking different projects. The project with the lowest total risk index is ranked the highest because it has the lowest risk impact on project performance.

4. CASE STUDY: RISK INDEX DETERMINATION FOR A CONSTRUCTION PROJECT

Risks are ever-present in construction project and they affect costs, time, and quality of project realization. They are unavoidable but manageable to the point of acceptable project risk. Zou, Chen and Chan (2010) say that risk management implementation "in construction projects may bring a number of benefits. Therefore it is necessary to have risk management as an integral part of a construction organization"s management practice" (854).

In order to determine the risk index, we conducted five interviews with project managers in organizations dealing with the design and realization of construction projects in Serbia. The aim of the interviews was to identify only the key risk factors/subfactors at the macro and micro levels and their significance and impact on project goals. Task, or activity, risks were not included in the survey, as they are project specific. Based on the results of the interviews, we defined factor/subfactor hierarchies at the macro and micro levels (Figure 2), created pairwise comparison matrices (Tables 4-7), determined the weights and quantified the impact (Tables 8 and 9).

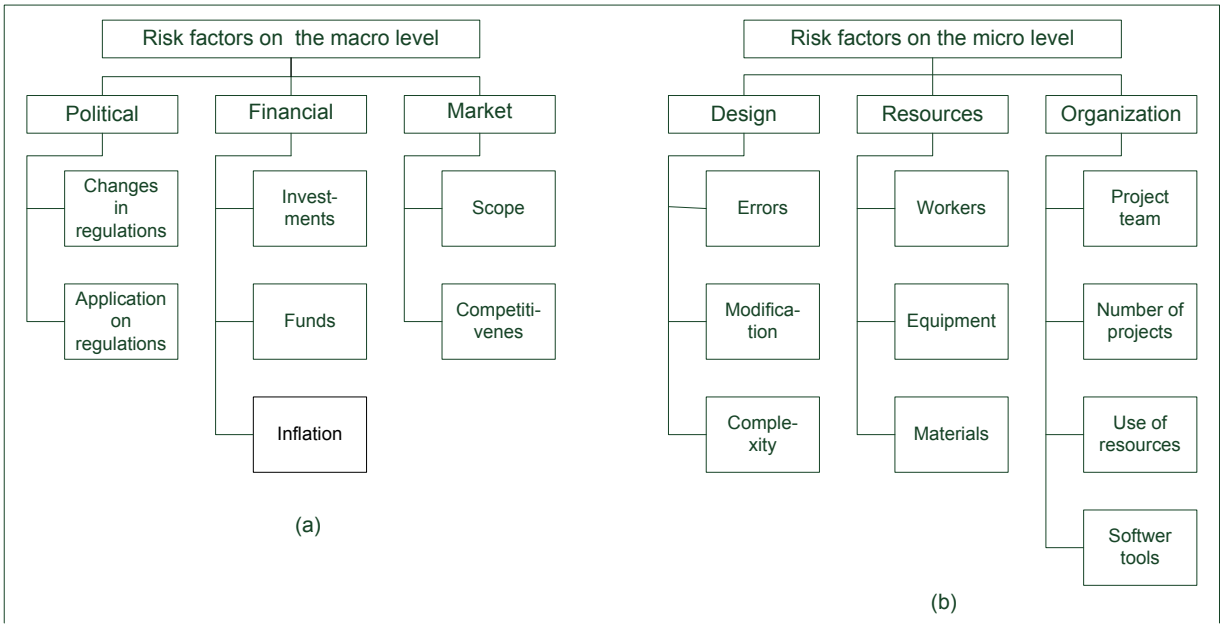

Figure 3: Risk factors hierarchy at the macro level (a) and the micro level (b)

Table 4: Pairwise comparison of factors at the macro level

	Politics	Finance	Market
Politics	1	3	5
Finance	1/3	1	3
Market	1/5	1/3	1

Table 5: Pairwise comparison of sub-factors in relation to factors at the macro level

Politics			
	Changes in regulation	Application of regulations	
Changes in regulations	1	1/3	
Application of regulations	3	1	
Finance			
	Investments	Funds	Inflation
Investments	1	5	3
Funds	1/5	1	1/3
Inflation	1/3	3	1
Market			
	Scope	Competitivenes	
Scope	1	1	
Competitivenes	1	1	

Table 6: Pairwise comparison of factors at the micro level

	Design	Resources	Organization
Design	1	3	5
Resources	1/3	1	3
Organization	1/5	1/3	1

Tabele 7: Pairwise comparison of sub-factors in relation to factors at the micro level

Design			
	Errors	Modifications	Compexity
Errors	1	3	5
Modifications	1/3	1	3
Compexity	1/5	1/3	1
Resources			
	Workers	Equipment	Materials
Workers	1	1/3	3
Equipment	3	1	5
Materials	1/3	1/5	1

Organization				
	Project team	Number of projects	Use of resources	Software tools
Project team	1	5	5	3
Number of projects	1/5	1	1	1/3
Use of resources	1/5	1	1	1/3
Software tools	1/3	3	3	1

Table 8: Weights, efects and risk index at the macro level

Factors	Factors weights	Sub-factors	Sub-factors weights	Sub-factors efects	Subfactors risk index
Politics	0.633	Changes in regulations	0.158	0.3	0.0474
		Application of regulations	0.475	0.2	0.0950
		CR=0			
Finance	0.260	Investments	0.164	0.3	0.0492
		Funds	0.028	0.2	0.0056
		Inflation	0.068	0.4	0.0272
		CR=0.0375			
Market	0.106	Scope	0.053	0.1	0.0053
		Competitivenes	0.053	0.1	0.0053
		CR=0			
CR=0.0375					
Sub-factors risk index sum					**0.2350**

Table 9: Weights, efects and risk index at the micro level

Factors	Factors weights	Sub-factors	Sub-factors weights	Sub-factors efects	Subfactors risk index
Design	0.633	Errors	0.401	0.6	0,2406
		Modifications	0.165	0.2	0,0330
		Compexity	0.067	0.2	0,0134
		CR=0.0375			
Resources	0.260	Workers	0.068	0.2	0,0136
		Equipment	0.165	0.3	0,0495
		Materials	0,027	0.2	0,0054
		CR=0.0375			
Organization	0.106	Project team	0.059	0.3	0,0177
		Number of projects	0.010	0.1	0,0010
		Use of resources	0.010	0.2	0,0020
		Software tools	0.027	0.2	0,0054
CR=0.0375		CR=0.016			
Sub-factors risk index sum					**0.3816**

The total project risk index, based on equation (2) and Tables 8 and 9, is:

$$R = R_1 R_2 = 0.235 \cdot 0.3816 = 0.0897$$

At both project levels risk is categorized as "medium risk" (R_1=0.2350, R_2=0.3816). Total risk also belongs to the category of "medium risk" (R = 0.03816). The highest risk at the macro level is caused by political and financial factors, such as: the application of regulations (0.0950), investments (0.0492) and changes in regulations (0.0474). At the micro level, the dominant risk results from errors in the project (0.2406); significantly lower risks are caused by equipment (0.0495), modifications of the project (0.0330), etc.

5. CONCLUSION

Risk management is a means of ensuring a project from potential harmful effects of certain events (within and outside of the project) on project realization. Through understanding potential problems, defining the possibilities to be monitored (or ignored) and threats to be responded to (or accepted), developing and controlling responses to potential risk, and creating the need for improvement of the project management plan, risk management contributes to the accomplishment of project goals in the best possible manner.

Risk index is a project risk measure. Its value will be more credible if the problem of project risk is considered at a large number of hierarchy levels (to activities level). This paper considered only two hierarchy levels with factor typical of all construction projects in order to show the procedure of risk index determination.

Nevertheless, every project has its own inherent risks which are to be considered when determining the risk index for a specific project.

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THEORY OF COMPLEXITY AND INNOVATION PROJECTS

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***Abstract**: Complexity, as a new paradigm of scientific thought, finds its place in project management. There is a high projects failure rate, and on account of this, there are many criticisms of traditional project management. The theory of complexity takes into account the context in which a particular project is observed. Innovation projects distinguish from conventional projects primarily, by a greater degree of uncertainty and risk, and they cannot be managed in the same way as conventional projects. The aim of this paper is to consider the complexity of the project and the project environment, searching for relationship with innovation projects, and to give some helpful recommendations for project managers.*

***Keywords**: theory of complexity, project management, criticism, innovation project, uncertainty, risk, project manager*

1. INTRODUCTION

Theory of complexity brings refreshment in traditional project management. Projects have always been guided by the Newtonian paradigm, which implies linearity, determinism and predictability. Despite this, there are many examples of failed projects. Simple rules of cause and effect are not always valid, and a large number of factors affecting the complexity of the project and project environment. Like complex adaptive systems, projects constantly need to adapt to these changeable factors.

Complexity paradigm supports innovation, because there is a strong connection between chaos and creativity. Innovation projects are not structured, their future is uncertain, and traditional tools for managing conventional projects are often not helpful in their case.

In order to provide successful project management, project managers have a lot of to learn from the theory of complexity. The challenge is to manage the chaos of innovation projects, to achieve an agreement within the project team, to predict the future in unpredictable environment, and to manage the risk of innovation projects.

2. INTRODUCTION TO THE THEORY OF COMPLEXITY

Mitchell (2009) writes that “the word *complex* comes from the Latin root *plectere*: to weave, entwine” (p.4). Cooke-Davies, Cicmil, Crawford, & Richardson (2007) concluded that complexity is “generally referring back to the Latin origins of the term (*complexus*, from *complecti*) in which *com* is combined with *plectari* meaning ply or braid” (p.51). It is clear that complexity in the main implies that something is composed of many parts, and there are difficulties in understanding the relationship among them.

Stacey matrix pinpoints the differences among the terms – simple, complicated, complex, chaotic. It contains two dimensions. The horizontal axis represents the degree of certainty, and the vertical axis the level of agreement (figure 1). Certainty means that it is possible to determine the cause and consequence relationship between these two events, but also to predict the future with certainty based on previous experiences. On the other hand, the arrangement means there is a group agreement among certain questions and decisions which are under consideration.

Five fields are observed on this matrix:

- Simple (1) – Close to Agreement, Close to Certainty;
- Complicated (2) – Far from Agreement, Close to Certainty;
- Complicated (3) – Close to Agreement, Far from Certainty;

- Anarchy (4) – Far from Agreement, Far from Certainty;
- **Complex** (5) – zone of complexity, it is located at the transition between zone of stability and zone of anarchy (the so-called "the edge of chaos").

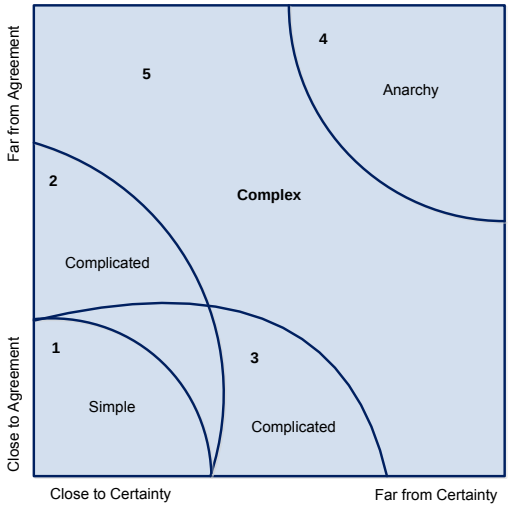

Figure 1: Stacey matrix (Zimmerman, 2001)

Classical science is based on linear systems and determinism, but simple rules of cause and effect are not always valid. Nonlinear systems make a fundamental concept of chaos theory, on which theory of complexity is based. This theory suggests that the universe is full of systems which are constantly adapting to the environment, and hence the term Complex Adaptive Systems (CAS). The rise of CAS as a school of thought took hold in the mid-1980's with the formation of the Santa Fe Institute (Dodder, Dare, 2000).

Adapting to the changes in the environment, CAS develop and evolve with it in time. Constant reorganization in finding ways for adapting to the changeable factors in the environment is present and it happens spontaneously. Systems evolve to the higher order degree through self organization. Keskinen, Aaltonen, Mitleton-Kelly, & Kauffman (2003) have explained that „complex systems are composed of numerous, varied, simultaneously *interacting parts* (or agents)" (p.7). The way in which system parts are mutually connected and the relationships among them are essential for the system's survival. Complex system isn't a mere sum of the parts, but an integrated whole in which very small changes can make huge differences in the results. Meteorologist Edward Lorenz had defined this phenomenon in 1963 as „sensitive dependence on initial conditions", that later, in 1979, called *„butterfly effect"* in one of his paper (Cooke-Davies, Cicmil, Crawford, & Richardson, 2007). Legendary, the flapping of a butterfly's wings in Brazil set off a tornado in Texas. There is high degree of connection among the agents, hence the tendency to fast and surprising behaviour changes. These changes, combined with sensitive dependence on initial conditions contribute to unpredictable behaviour in long-term. Within CAS it is still possible to spot a certain order, and certain patterns of behaviour that lead to the evolution of the system, while all details of the system cannot be fully comprehended.

3. CRITICISMS TO THE TRADITIONAL APPROACH OF PROJECT MANAGEMENT

In addition to constant knowledge improvement on project management and sophisticated development tools and project management techniques, there are still many examples of failed projects or partly unsuccessful projects (based on the following – time, costs, and quality). On account of that, there is criticism toward traditional project management.

"The paradigm of the traditional approach refers to a predictable environment, where the success of the project is attributed to adherence to pre-established standards, and failure is attributed to lack of adherence to the same standards. However, doubts have been raised about the validity of this paradigm and the implicit assumptions for the effective management of projects." (Marquees, 2012)

More attention should be dedicated to context contemplation in which the relative project is being observed. Without the corresponding project environment analysis, or even by ignoring its individuality, easily accessible, verified and "quick" solutions are suggested. However, in practice it often turns out that universal

solutions are not always the best ones, so it is preferable to apply contingency management access because the very definition of the project calls it a unique business venture.

It is often cited in literature that it is necessary to connect interior processes of a project with historical and organizational context since “no project is an island”. Engwall (2003) points out that “in order to understand the inner life of a project in depth, it also needs to be analyzed in relation to: (1) experiences from past activities; (2) politics during the pre-project phases; (3) parallel courses of events happening during project execution; (4) ideas about the post-project future; and (5) institutionalized norms, values and routines of the project’s organizational context” (p.791).

In addition to other complaints, Packendorff (1995) notices it is wrong to treat projects as means for goal attaining, and not premature organization.

4. INNOVATION PROJECTS SPECIFICATION AND RELATION TO THE THEORY OF COMPLEXITY

Complexity paradigm supports innovation. The complexity zone is to be seen on the transgression between the arrangement zone and the chaos zone on a Stacey diagram. “In the zone of complexity the traditional management approaches are not very effective but it is the zone of high creativity, innovation, and breaking with the past to create new modes of operating” (Zimmerman, 2001).

Various types of innovation projects are shown on the figure 2: technology, research, new product development projects and other projects. “Conventional projects tend to have clearly defined goals and targets. On the opposite, innovation projects might not necessarily have this detailisation. Innovation is often elusive and cannot be described before it is actually achieved” (Filippov, Mooi, 2010).

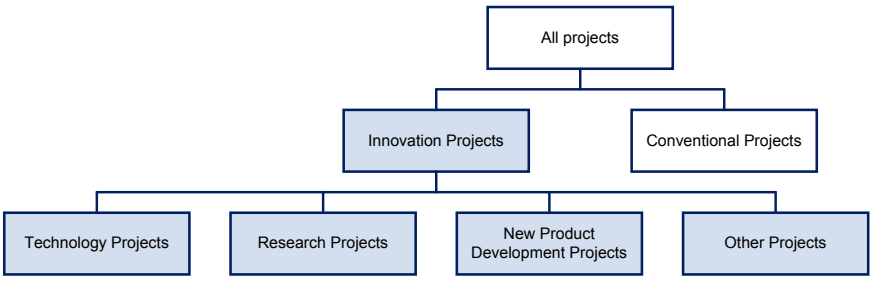

Figure 2: Classification of projects (Filippov, Mooi, 2010)

Innovation projects are distinguished from the conventional projects by its higher degree of uncertainty and risk. They cannot be managed in the same way as conventional projects since it is necessary to include more creativity when compared to standardized methods. In addition, traditional tools for managing conventional projects are often not helpful in managing innovation projects.

Learning is an another important feature of innovation projects. Harkema (2003) concluded that “learning is not focused on the procedural aspect of innovation projects, but on the relational aspect that underlies interacting people” (p.17).

5. PROJECTS MANAGEMENT, INNOVATION PROJECTS MANAGEMENT, AND COMPLEXITY

5.1 Project Complexity

Williams (1999) sees project complexity in two dimensions (figure 3): structural complexity and uncertainty.

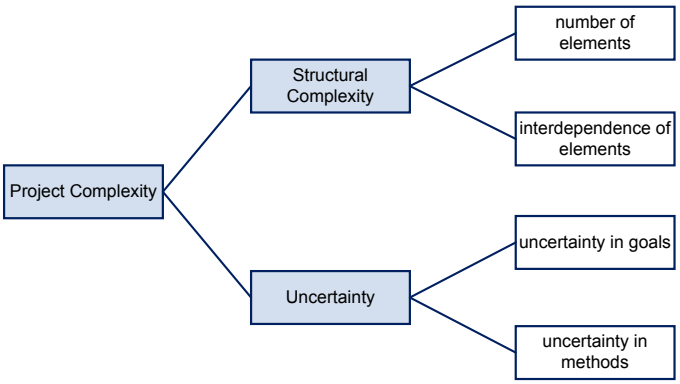

Figure 3: Project complexity (Williams, 1999, p.271)

Projects such as complex adaptive systems are comprised of a great number of elements which have a mutual interaction. Since "complexity can be characterised by two main aspects – quantitative and qualitative" (Geov, 2007, p.1), the quantity complexity aspect in the projects comes from a number of activities and different kinds of activities (for example, preparational activities, operational activities, the ones that happen on paper or in the field, etc.) These activities are mutually intertwined, so it is obvious that there is a great number of connections and dependences which are different as well. For example, in Precedence Diagramming Method (PDM) there are four types of connections: Finish-to-Start (FS), Start-to-Start (SS), Finish-to-Finish (FF), Start-to-Finish (SF). All these relations can have specific lags (such as FS2). Quality complexity aspect is the consequence of quantity aspect when due to many activities and relationships among activities in the project, perception exacerbates and behaviour of the project becomes unpredictable. Apart from the number of activities and number of connections, theirs differences are important for quality aspect of complexity, as well as variability of resources engaged in the project.

When it comes to innovation projects, the biggest problem is weak structuring. There is no previous experience in order to create something new (whether it's a new technology, a new product, or research), and because of that it is hard to know beforehand all tasks that will be undertaken on the project. Frequent changes in the project are usual, as well as the lack of understanding of their consequences.

The *butterfly effect*, known as an important non-linearity factor, is present in the management project systems. Little changes in certain phases of projects can influence the ultimate outcome. Moreover, if we repeat the same thing in a project, we won't get the same results every time. It is sometimes hard to connect cause and consequence since nonlinear behaviour is common for big projects. Apart from the great number of events and high degree of interdependence, what also influences this is organizational structure layers in the project and project relationships with other projects (Remington, Zolin, 2011).

The risk and uncertainty of the project are the highest in its initial phase (figure 4), when it is necessary to define the desired goals of the project. There are additional difficulties in risk management of innovation projects, because project risks come from different sources: management, technology and market (Stosic, Isljamovic, & Mihic, 2013).

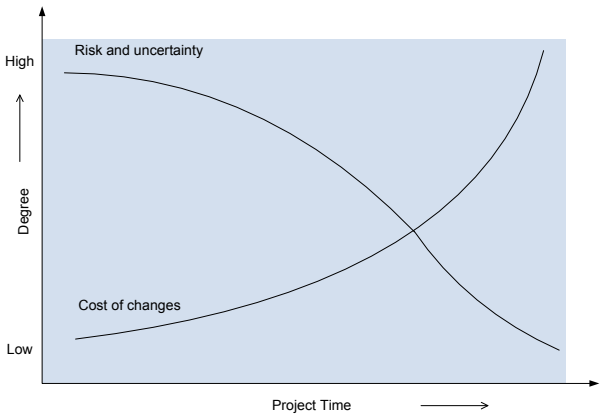

Figure 4: Impact of Variable Based of Project Time (PMBOK, 2013, p.40)

Having in mind that a great number of factors from the environment affect the project complexity and that projects can be long-lasting, it is necessary to examine the adequacy of originally established goals and redefine them. Projects are adjusted to changeable circumstances in the environment like complex adaptive systems. By changing the project goals, methods used for their achievements are changed.

In the same way that CAS behaviour cannot be predicted in a long period of time (similar to weather forecast), it is not possible to predict future occurrences in the projects whereupon its outcome is uncertain.

5.2 Environment project complexity

If project as a structure is being observed, then its closest environment is made by the people participating in its realization. It is important to consider complexity with project team where the source of complexity comes from the human factor in the first place and then from problem complexity problem which is before the team. The life cycle of a project team consists of several phases and certain patterns of behaviour characteristic to it can be seen. Life cycle of a project team consists of several phases and certain behavioural patterns characteristic for each of them can be spotted. There is the highest complexity during the storm phase, when the situation is far from agreement, precisely as it can be seen on the Stacey matrix, that is to say when the agreement among the team members cannot be achieved. Further during the norming phase and functionality phase projects team members agree, overcome conflicts, and move to the „agreement zone“.

All differences between virtual project leadership and leadership in a traditional environment aren't addressed in the PMBOK Guide (Curlee, Gordon, 2011). According to the PMBOOK Guide (2013), part X3.7 Political and Cultural Awareness, „an effective way to manage this cultural diversity is through getting to know the various team members and the use of good communication planning as part of the overall project plan“ (p. 542). But Curlee and Gordon (2011) considered that this „does not offer any practical recommendations about handling the leadership of a culturally diverse or a geographically dispersed team“ (p. 28). There is a chaotic nature of communication in a virtual project, where lines of communications are tangled and less affected by hierarchy (Curlee, Gordon, 2011), so communication plan must be more flexible and more capable for adjusting the changes. One should be particularly cautious in the case of managing the innovation projects by a virtual project team. Some authors think that virtual projects can exacerbate innovation. Chesbrough and Teece (2002) say that „loose partnerships of companies inevitably produce more conflicts of interest than do centrally managed corporations, and those conflicts can hamper the kind of complex, systematic innovation that creates valuable business breakthroughs“ (p.127).

Stakeholders of a project in accordance with standard BS ISO 21500:2012 are shown on picture 5. All of them together are in mutual interaction which increases project environment complexity. That is reflected on the project itself having in mind that it necessary to fulfil the demands and expectations of all stakeholders and oversight by neglecting any of the sides could lead to project failure.

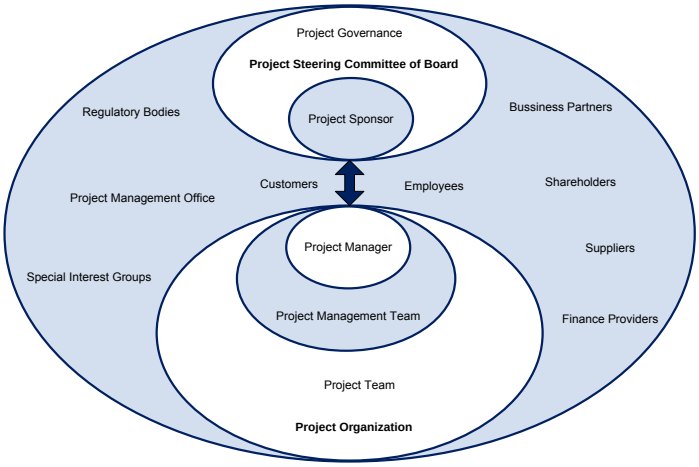

Figure 5: Project stakeholders (BS ISO 21500:2012, p.7)

Even though complexity theory does not advocate the use of any models, just by emphasizing the individuality of each project as well as the impossibility to show complexity by models and ruined picture of reality, there are several attempted models of project management when it comes to complexity.

5.3 Project management models

Depending on **project complexity** and **environment project complexity** which have previously been discussed, Jaafari (2003) suggests the following four project management models:

- Ad hoc model – project complexity and environment project complexity are low, the project management has no system approach, nor the occupation of the project manager can be recognized, decisions are made as you go along, the focus is not on long term achievements;
- Bureaucratic model – project complexity and environment project complexity are low to moderate, the approach is characteristic for projects in the public sector, the focus is not on achieving optimal project results as much as it is on administration respect;
- Normative model – it is distinguished by high project complexity and moderate environment project complexity, the modern model is usually described as the model of the best practice;
- **Creative-reflective model** – there is a high project complexity as well as very high environment project complexity, projects are not structured, the environment is changeable, study and project managers' creativity are necessary.

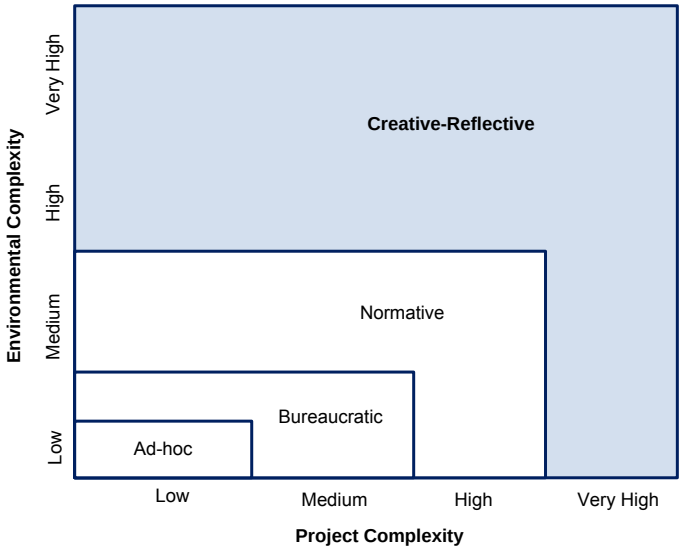

Figure 6: Schematic comparison of four models of project management in terms of complexity (Jaafari, 2003, p.55)

Basically, this classification reflects project management evolution through time in attempt to respond to ascending increase of environment and project complexity (Jaafari, 2003). In this work, the most important is the last crative-reflective model (figure 6) and here is the link with innovation projects.

6. RECOMMENDATIONS FOR PROJECT MANAGERS

The complexity paradigm challenges the conventional understanding that consensus is a good thing. It stresses the importance of expression of different opinions, debate and dialogue in order to promote the creative powers and the presentation of conflicting opinions. Depending on the level of complexity, project managers are advised to use different approaches in decision making process (table 1).

Table 1: Decisions in Multiple Contexts (Ameen, Jacob, 2009, p.14)

Context	Context caracteristics	Approach
Simple	• Repeating patterns and consistent events • Clear cause and effect relationship • Known Knowns	• Sense, categorize, respond • Ensure proper process in place • Best Practices and clear communication

Complicated	• Expert Diagnosis required • Cause and effect relationship not apparent • Known Unknowns	• Sense, Analyze, respond • Create Panels of experts • Listen to conflicting advice
Complex	• Unpredictability and competing ideas • No right answers • Unknown Unknown	• Probe, Sense, Respond • Increase level of interaction and communication • Use methods to generate ideas
Chaotic	• High turbulence • No clear cause and effect relationships • Many decisions to make and no time to think	• Act, Sense, Respond • Look for what works instead of seeking right answers • Provide clear direct communication

In the article 8.1.2.3 (PMBOK, 2013), Ishikawa cause-and-effect diagram is presented as one of the seven tools for quality management. It is used for conceptualization and presentation of relationships among the consequences given (for example, quality characterists' variation) and their potential consequences. It is based on the concept of linear systems, that is to say cause and consequence relationships. Their presentation looks like a fish skeleton (figure 7). Complexity theory pinpoints this tool's flaw. It presupposes one way causality and it doesn't include feedback from effect to causes. As it is shown on this example, classic tools for solving problems can possess flaws when observed form the complexity theory prism. It is possible to use them in certain situations, but it is necessary to develop individual tools for solving problems simultaneously.

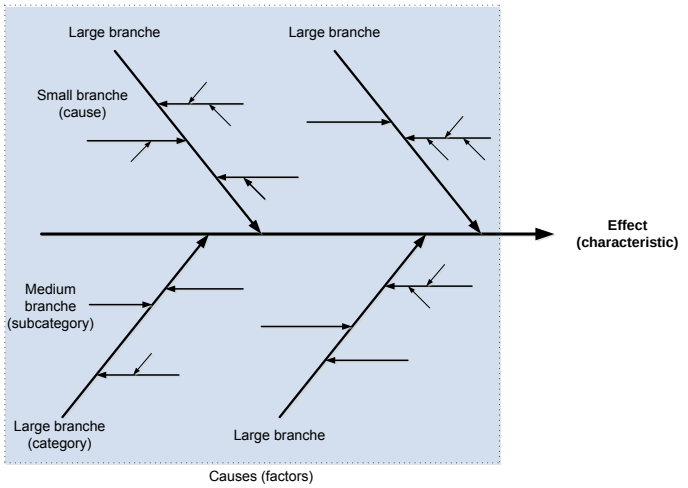

Figure 7: Ishikawa cause-and-effect diagram

In addition to standard tools, there are other tools that project managers can use to help manage the chaos and successfully manage complicated systems. For example, Ojha (2011) suggests *enneagram*, that is originally a tool for personality mapping, but also it can be helpful for project manager to find order in between chaos, by identifying underlying patterns in an organization, because „the map allows project managers to predict certain outcomes, which results in more reliable management systems" (Ojha, 2011).

A great dose of uncertainty in the process of planning the realization of the project, which applies mostly to the innovation projects, when the managers doesn't have previous experience in realization of the relative project. Therefore, the project manager should find an adequate way to treat the present uncertainty in their calculations. PERT method for time planning is suitable to use in these kinds of circumstances. It considers optimistic and pessimistic duration time of an activity in order to get the calculation of the most probable, the most expected duration. Complexity theory advocates inclusion of *fuzzy* numbers during the calculations of a *fuzzy* critical way, so it supports the application of *fuzzy* PERT method with a view to avoiding subjective evaluation of activity duration by the project manager.

In order to provide successful risk management of innovation projects, it is advisable that project managers use combination of the Work Breakdown Structure – WBS and the Risk Breakdown Structure – RBS, called Risk Breakdown Matrix – RBM (figure 8), (Stosic, Isljamovic, & Mihic, 2013). WBS is a structural diagram showing affairs and tasks which need to be performed within a project. RBS identifies project risk, which in

case of innovation project includes management, market and technology on the first level (Stosic, Isljamovic, & Mihic, 2013). RBM is a useful tool for reducing uncertainty in the initial phase of innovation projects.

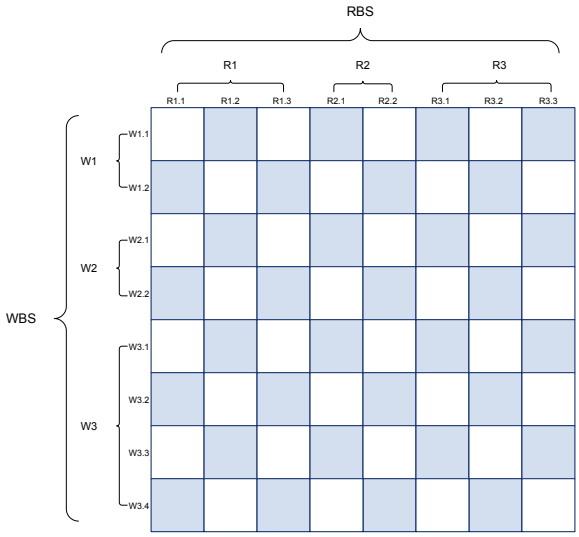

Figure 8: Simple Risk Breakdown Matrix (Stosic, Isljamovic, & Mihic, 2013)

7. CONCLUSION

In comparison to traditional project management, the advantages of incorporating complexity management in project management are significant. Closer consideration of project context is the key to successful project management. Theory of complexity teaches project managers how to deal with complexity, which comes from high project complexity and from very high environment project complexity.

The successful management of innovation projects on “the edge of chaos” is based on an optimal balance between order and chaos. When classic tools of project management are not helpful, it is necessary to develop individual tools. Complexity theory advocates inclusion of *fuzzy* numbers in project planning phase for reducing uncertainty. Risk Breakdown Matrix can be solution for risk management of innovation projects.

Further studies of these topics are related to empirical research that should analyze complexity in the field of project management innovation. Such research would be based on practice in Serbian organizations and have to analyze the key sources of complexity in the innovation projects, which come from weak structuring, great number of poorly known activities, high degree of interdependence among events, uncertain future, high degree of risk, chaotic communication among project team members, cultural and sociological differences in virtual teams, organizational structure layers in the project, project relationships with other projects, stakeholders, technology, market. The aim of this research is to modernize traditional approach of project management, to obtain benefits from the chaos, and improve the PM competencies.

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SELECTION AND PRIORITIZATION OF CAPITAL PROJECTS IN THE PUBLIC SECTOR

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Abstract: *The article aims to discuss the project governance system as a linkage between policies and projects in order to improve success of the public investment projects in developing countries. According to many researches there is increasing number of projects that cannot satisfy the public needs and priorities. Capital projects have also suffered huge costs and time overruns. On the other hand, demand for public capital projects increases because they strive to economic and social development of one society. The key for this paradox situation is establishment of project governance system which should help allocating scarce resources to high-priority public needs. This article gives literature review and points out challenges, critical factors and key features of successful model for project selection and prioritization.*

Keywords*: capital projects, public sector, project governance*

1. INTRODUCTION

There is no doubt that projects are important part of corporate and public life. They are identified as a policy implementation tools whit the aim to contribute to resolving social and economic problems. In order to contribute to human capital improvements, many developing countries invest in infrastructure, education, healthcare and other physical assets. These countries encounter difficulties in developing and implementing public investment programs that meet their needs (Tandberg, 2014). The majority of public projects is very large and complex and requires significant resources in order to be implemented. Furthermore, public projects suffer significant political pressure and they are subjected to public scrutiny. Ad-hoc decisions, huge number of uncertainties and poor methodology encroach upon selection and realization of highly beneficial projects. There are significant inconsistencies and differences in quality between different investment proposals and in many developing countries even the costing of the projects is inadequate. It is widely known that traditional project management performance measures are no longer enough to assess one project as a successful. Nowadays, the key of project success is to create a value - to contribute to strategic goals. Identifying these projects is very difficult especially in public environment which is complex and uncertain and it deals with stakeholder management issues and political pressure. Therefore, it is highly important to select projects which are aligned with public needs and other projects within project portfolio without wasting limited resources.

A result of bad project selection and realization, lack of information, wasting of resources and lack of technical competences are low yields on the public investments. Thus, it is very challenging to ensure making consistent public investment decisions across different sectors and projects. In order to increase yields on the public and private investments there is a need to make an effort to actually invest in the investment process. For developing countries it is vastly important to provide support for carry out development projects. It is clear that investing in the investment process has a high priority and it involves non-politicized selection and prioritization of public projects as well as project monitoring, controlling and ex post evaluation.

This paper discusses some key issues and challenges related to selection and implementation process of investment projects. As we identified nontransparent, politicized and poor project selection methodology as a main cause of wasting public resources on projects with limited social value, we wanted to find out how developed countries managed to establish system for project selection which indeed contributes to country's strategy. We have pointed out above that developing countries need to invest in investment process which will ensure selection and realization of projects which create a value, in other words, developing countries need to invest in investment process which contribute to strategic goals. This linkage between public needs and project objective is project governance. Many industrialized countries have implemented effective project governance system at the top governance level which has resulted selecting the right projects. Project governance was subject to research of many authors and institutions which motivated us to write this article with the objective to present key features of well-functioning public investment process and critical factors for successful implementation of project governance. Finally, this paper should give the basis for further researches which could help build effective process of project selection and prioritization in developing countries.

2. THE VALUE OF PROJECT MANAGEMENT IN THE PUBLIC SECTOR

Dynamic and changeable environment presses organizations to undertake complex and rapid initiatives. However, despite the increasing level of investment being made by organizations in projects, a startling number of initiatives fail to deliver the expected value, never get implemented, or cost substantially more and take substantially longer than planned (Williams & Parr , 2004). For the organizations it is not just important to formulate good strategy, it is equally important to implement it. Here important role has project management. Project and project portfolios are “powerful strategic weapons” (Shenhar, Levy, & Maltz, 2001) and they are considered as critical component for linking strategy to short-term actions (Kaplan & Norton, 2008).

While in the private sector projects have the aim to deliver strategy, in the public sector they are policy implementation tools. In the public sector there is a need for improving performance and ability for successful implementation of change. These take a form of projects which should be aligned with the important priorities in the society and the needs of the users. Projects are designed with the aim of delivering economic, institutional and social development (Shiferaw & Klakegg, 2012). The governments around the world support project management in order to contribute to effective governance through transparency and accountability, efficiency and effective resource usage, improved implementation of policy and change and maintenance of public confidence (Crawford & Helm, 2009).

Many authors claim that important problem in the public sector is the fact that public investment projects are implemented without examining the public needs and priorities. As a result in the public sector there is a situation that the need for projects is increasing but on the other hand the numbers of projects which truly satisfy the public need are decreasing. The phrase used for description of these projects is “white elephant” meaning projects whose cost and subsequent upkeep is much greater to the owner than its value (Williams & Samset, 2010). However, reason for project failure is not lack of efficiency. Projects are not managed badly, what is more management and governance of projects have shown improvements in recent years.

It is emphasized that quality at entry has important role in successful project delivery whereas quality identification, preparation and appraisal have more powerful influence on project performance than key county economic variables, external factors and government consideration (The World Bank, 1996). There exist a need for alignment between organizational strategy and the project concept. Additionally, there is necessity to deal with complexity of project, his impact on other projects in portfolio, and sustainability. Public investment project failure is a consequence of poor project selection methodology as it is not developed from development policies and strategies and in some cases policy/ strategy does not even exist (Shiferaw & Klakegg, 2012). On the one hand, there is no formal and clear system for checking if and how much proposed project contributes to government strategy realization. Furthermore, there is no established system for checking the level of public needs involved in the government objectives. There are a lot of evidence that there is a low efficiency of public investment, which includes delays in design and completion of projects, corrupt procurement practices, cost over-run, incomplete projects, and failure to operate and maintain assets effectively so that the benefits are less than they should be (Rajaram, Minh Le, Biletska, & Brumby, August 2010). Consequently, in the public sector it is difficult to map public needs and priorities, and to analyze the relationship between policies and projects. As a result an argument that fiscal space allocated to public investments should enhance economic prospects is negatively affected. In the public sector, investment projects are facing with cost underestimation and benefit overestimation due to flawed information and methods or systematic skewed estimation which might be politically motivated (Williams & Samset, 2010).

It can be conclude that there has to be established link between project and policy of the country. That is the only way to select and implement projects that meet goals and objectives and expectations of key stakeholders. Traditional approach of project management is no longer enough – the only value which project could give is not only delivering planned output within cost and defined time frame. The main project’s aim is to meet strategic goals. If that is not the case, not only that project will not be implemented, it could also cause the new problems. Therefore, it is important that projects are aligned with strategy. In that way it can contribute to strategy implementation and ensure that benefits are reaped from its realization. This conclusion is confirmed by Williams and Samset (2010), who point out that planner need to have a broad and long term perspective and allow different concepts to be considered in order to succeed in strategic terms. Furthermore, planning should decide on the direction and strategic framework for a project, and anticipate difficulties that might occur, in order to make the right tactical choices.

3. LINKING PROJECTS TO STRATEGY

A result of bad project selection and realization, lack of information, wasting of resources and lack of technical competences is low yields of the public investments. In order to increase yields on the public and private investments there is a need to make an effort to actually invest in the investment process. It is already said above that one of the World Bank's research indicates that quality identification, preparation and appraisal have more powerful influence on project performance than key county economic variables, external factors and government consideration. There is a strong necessity for linking project to country's strategy or sector's strategy in sense of selecting projects which contributes to strategy realization.

Alignment of project and strategy is a role of project governance. Project governance was a subject of many authors and it is identified as a critical successful factor for the delivery of projects (Garland , 2009) and effective project governance is a key feature of successful investments (Weaver , 2007). According to Organization for Economic Co–operation and Development (OECD) public governance refers to formal and informal arrangements that determine how public decisions are made and how public actions are carried out, from the perspective of maintaining a country's constitutional values in the face of changing problems, actors and environment. Turner (2006) points out that project governance provides the structure through which the objectives are set. Main goals of effective government of project management are choosing the right projects in order to ensure that project portfolio is aligned with organizational objectives, delivering chosen projects in that way there is no wasting of project resources, and ensuring that projects are sustainable. On the contrary, poor project governance results in project that does not achieve objectives and does not satisfy public needs and priorities and as a final result does not have positive long term effect (Shiferaw & Klakegg, 2012). In brief, poor project governance leads to project failure while good project governance leads to selection and effective implementation of projects that meet the need of stakeholders.

In order to make possible and effective governance of public investment projects, structure and principles have to be defined through creating governance framework. The governance framework is documented to have vital significance for the planning and management of projects. Klakegg et al. (2012) claims that governance framework is an organized structure established as authoritative within the institution, comprising processes and rules established to ensure project meeting purpose. The governance framework needs to enable projects to be flexible in order to adapt to turbulent environment, ambiguous, fragmented and political reality of project situation. In high performing countries high-quality procedures for planning investment projects have played a vital role (Shiferaw & Klakegg, 2012). Several developed countries have started a development process to strengthen the ability to manage and control major public investment projects. In this paper we will present a short description of Norwegian project governance framework and project governance framework established by of UK's Ministry of Finance as an example of effective project governance. Additionally, these examples will help us to point out "must have features" of every project selection and prioritization process which have to be to incorporate.

The World Bank has identified eight key "must-have" features of a well-functioning public investment system. These features are investment guidance, project development, and preliminary screening; formal project appraisal; independent review of appraisal; project selection and budgeting; project implementation; project adjustment; facility operation; and project evaluation (The World Bank, 1996). Regarding to the identified features of well-functioning public investment system and previously mentioned fact that there is a need to establish formal framework for project selection and implementation, it can be concluded that the starting point for effectual project government system is creating clear development policy and strategy which is in line with public needs and priorities. Projects are initiated from the policy direction of the government formally presented in some strategic plan (Shiferaw & Klakegg, 2012). Policy and strategy are designed by the influence of public needs and priorities and government executives. While government sector is responsible for policy direction, implementation sector is responsible for transferring strategy to actions. It is important that there exist the quality assurance system, with formal criteria in order to ensure the alignment of project and objectives, as a link between the government executives and implementation sector. Strategic guidelines provide selection of investments based upon priorities of the development policy. Therefore, strategic guidelines have to be strongly associated with national and sector strategy. The formal process for project development has to be developed. Every project has to go through the first level screening in order to estimate if project meets the minimum criteria of consistency with the strategic goals of government and if project is cost effective. After first screening test, the projects which meet minimum request are subjected to further economic and financial analysis. There is a require for feasibility analysis that consists of two key components: prefeasibility study which identifies alternative projects and feasibility study which analyses the alternative strategies in depth as well as undertaking social and environmental analysis. The feasibility collects all relevant data from prefeasibility study and outlines all possible outputs and outcomes. It is important that government has formal guidance on the technical aspects of project appraisal appropriate to the technical capacity of ministries and departments. In this condition, project's social and economic value

can be evaluated. However, project's macro, sectorial and project-specific uncertainties should be included into calculations end evaluation process. Consequently, a new investment should only occur when rehabilitating existing assets is not as cost effective as undertaking investment in a new asset (Rajaram, Minh Le, Biletska, & Brumby, August 2010).

Miller and Hobbs have concluded that there is strong correlation between the variety of strategies deployed, strategic depth and project performance (Miller & Hobbs, 2005). Even though, the clear and detailed strategy has to be defined before project selection, preparation and implementation, there exist a necessity for strategic flexibility due to high uncertainty and risk of capital projects. Investment projects are very long and have critical front-end where this front-end phase of projects can last many years. Thus, capital projects have to be developed through time-dependent, non-linear and iterative process. Successful project implementation and alignment with strategy require a strong sponsor, a strong leading coalition and flexible governance structure. If projects are not embedded in institutional framework, every project success will happen by accident. Consequently, without defined methodology for project selection there is practically no chance that projects will deliver strategic values.

4. MODELS FOR SELECTION OF INVESTMENT PROJECT

In the previous section we have emphasized that project success depends on the benefits realized by the venture. In other words, project efficiency – delivering projects by using "iron triangle" (time, cost and scope/ quality), is no longer only relevant measure for judging project performance. Therefore, Zwikael and Smyrk (2012) have proposed the "triple – test" framework which identifies three levels of project success and these are: *project management success*, *project ownership success* and *project investment success*. According to this framework, on the first level efficient project delivery should be judged through evaluation of four criteria: fitness–for–purpose, the time taken, the costs incurred and triggering undesirable, unacceptable or avoidable outcomes. Project effectiveness is measured on the second level where a project success criterion is achievement of the approved business case. In this context, project effectiveness depends upon the ability to adjust to the project environment. That means that every project requires specific outcomes measures that are adapted to organizational context in which the project is taking place. On the final level - third level, determinant of project success is project investment success. Project investment success is estimated through the *Project Investment Evaluation Model (PIE)* (Zwikael & Smyrk, 2011) and it is function of *worth* and *riskiness.*

This model is a ground for developing project governance frameworks. A few industrialized countries have managed to execute project governance systems. On the other hand developing countries are still struggling with low efficiency of public investments (Era Dabla-Norris, 2011). In this paper we will present Norwegian project governance system and UK Gateway review process as examples of governance systems which ensure best practice in planning at the front end. Furthermore, we will emphasize the aspects of project governance that should be upgraded with the aim of establishing process for project selection and evaluation that guarantees the selection of right public investment projects.

The Norwegian project governance system was established in the year 2000 where the aim was to reduce cost overran through introducing control measures in order to ensure realistic budgets and good basis for project execution. Establishing project governance system was a bottom-up process within Ministry of Finance. This system has two key decision points: Quality Assurance 1 (QA1) which refers to making decision to initiate project preplanning, and Quality Assurance 2 (QA2) which refers to making decisions about financing the project. The first quality assurance system (QA1) includes a needs analysis, a strategy document, alternative analysis and overall requirements. The second quality assurance system (QA2) includes cost estimation, contract strategy and an overall project management document. The Sectorial Ministry is responsible for large investment projects and the decision-making process. There is intention to establish system where politic and administration is well divided through interplaying and understanding of both sides.

In the United Kingdom, OGC (*Office of Government Commerce*) project governance framework was also established in the top-down process through implementing the management system. The OGC Gateway™ Process is designed to provide independent guidance to Senior Responsible Owners (SRO), program and project teams and to the departments who commission their work, on how best to ensure that their programs and projects are successful (Office of Government Commerce (OGC), 2007). Projects are examined at key decision points where this process is known as Gateway review process. There are six Gateways:

- Gateway Review 0: Strategic management;
- Gateway Review 1: Business justification;
- Gateway Review 2: Procurement strategy;
- Gateway Review 3: Investment decision;

- Gateway Review 4: Readiness for service;
- Gateway Review 5: Benefits realization.

OGC Gateway Review assesses the project's viability, the potential for project success, the value for money to be achieved, and the proposed approach for achieving delivery of the project's objectives (Office of Government Commerce (OGC), 2007). The OGC Gateway™ Process is a guideline where project could be grouped in four levels by their criticality. The project board for the project with top level of criticality - "mission critical" projects- is the OGC and it has responsibility to inform the Prime Minister's office about the decisions made. Senior people use Gateway process for making decisions about "high criticality" projects. On the next level consisted of "medium-criticality" projects it is important that there exist collaboration of OGC and departments regarding available resources. "Low-criticality" projects – projects on the last level is reviewed within departments.

The Norwegian project governance system is simple, strategy and concept are chosen in early stage and the most important criteria for judging projects are cost and risk. On the other hand, the OGC Gateway™ Process provides complete guideline how to achieve project's goals and objectives, strategic assessment is repeated within the program and projects are focused on creating value for money. Some of these differences are caused by cultural differences and maturity of the frameworks (Klakegg, Williams, Magnussen, & Glasspool, 2008). Regardless of the specified differences, the both project governance frameworks embedded governance principles, such as: transparency, willingness to change, setting common and high professional standards, and external control and nonpolitical review. Their aim is to base project on needs of the users and to implement the quality assurance system where the experts will make decisions closely collaborating with the highest political level. It can be conclude that building accountable and effective public institution requires devising quality assurance system and governance frameworks.

It is clear that the project selection process should establish and incorporate standards for project estimation and selection which have to be assessable. With the aim of ensuring project social and economic value, government has to develop and implement formal and public guidelines for technical aspects of project estimation. For selection of right projects, the nature of strategic guidance, availability of sector strategies and transparency of appraisal are not the only important factors for selecting required projects. As much it is important that there exist the independent review of appraisals conducted (Era Dabla-Norris, 2011).

In this paper we used information from the report of PEMPAL (*Public Expenditure Management Peer Assisted Learning*) countries from the year 2011. According to this report, in developing countries first obstacle for developing effective project governance system is the fact that sectorial strategies do not include enough information so they are not adequate basis for project prioritization. Developing countries are also affected by the lack of formal and precise guidelines for economic analysis. Independent project assessment is one of the issues, too. The reason to claim this is the fact that only four members of PEMPAL countries have external project revision and just in two countries the Ministry of Finance has established standards for project selection and prioritization.

If we compare project selection processes in the developing countries and in the developed countries such as Norway and UK, we can claim that developing countries have to invest in creating and incorporating formal and transparent project selection process. Critical factor for successful implementation of project governance is commitment of government executives. In developing countries the often case is that the government has not implemented project governance system and projects are selected randomly or there is no formal project governance system. For successful implementation of project government system it is important to consider culture norms. That is why it is not possible just to copy entire governance system from developed country. Establishing the formal government framework is important so that stakeholders could ensure successful investment. On the other hand, donors and financial institutions have developed their own methodologies for project support. It could be concluded that county should considered the interest of all stakeholders in designing a project governance systems.

5. CONCLUSION

This paper considers issues affecting how transparent and effective model for project selection and prioritization can be set up, in circumstances where there is a great level of uncertainties, stakeholder management issues and political pressure. The aim was not to build the governance framework, but rather to point out criteria that should be incorporate in system for selecting public projects. This subject inspired many authors in the field of project management to research reasons for capital project shortfalls. We have tried to offer an insight in author's opinions and suggestions. There could be some disagreement, but one is for sure: projects have to be aligned with the top level strategy. Therefore, the first step in developing effective project

selection process is formulating strategy which reflects public's and stakeholder's needs, on both top government and sectorial level. One of the most important rules for successful strategy execution is understanding the management cycle that links strategy and operations. Even though project initiatives in developing countries fail due to lack of information in sectorial strategies, poor project governance is identified as a main cause of project strategic shortfall. In the public sector, project governance has objective to underpin strategy implementation.

We have shown that individual authors and institutional authors, such as the World Bank and International Monetary Fund claim that poor project realization is a consequence of political pressure, corrupt procurement and non-transparent appraisal standards. Capital projects are highly complex and require making judgments about future when there is only scant information. Consequently, they are suitable for political manipulation. Referring to that, quality of identification, preparation and appraisal is crucial for capital projects success. Cost and schedule underestimation and benefits overestimation result in strategic underestimation of projects in the front-end phase due to flawed information and politically motivated processes. It is clear that without good model for project appraisal and selection, every project success is accidental. Countries determined to increase yields on the public and private investments have to invest in investment process which should ensure strong linkage between the projects and strategy.

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PROJECT MANAGEMENT ON INTERNET – BLOGGERS AS FOCUS COMMUNITY

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Abstract: *Start with "why" is guide idea of research. Blogging and bloggers are something that each manager connects almost every day. For somebody that is idea of inspiration/curiosity; for others that is idea of motivation. In the research blog posts (articles) are idea of inspiration/curiosity. The research is established with materials from referent project management journals and conferences. Our "why" means that research take a challenge to explore; who is the author of the blog that managers read weekly or with similar frequency? Furthermore, research concludes that bloggers take inspiration from both experience and research literature.*

Keywords*: Project Management, Blogging, Project Manager, Information Technology*

1. INTRODUCTION

When the Project Management Institute (PMI) was founded in 1969, the term Blog (Blogger)—as it relates to the Internet and new technology—was not yet part of the common business vocabulary. Forty years after the founding of the Institute, issues related to blogging on project management topics became popular in the internet, management, business and marketing context.

Nowadays, the Internet is a first communication tool for both life and business. The Project Management (PM) is one of the most popular topics in business part. The research take a challenge to study questions: what are the main issues in terms of project management covered by the most popular Blogs? What are the authors' profiles of Blogs articles on the project management topics? To answer these questions, researches conduct a content analysis of ten blogs articles on the PM that were published in 2013. Bloggers and blogs are just the inspiration for topics and ideas; the topics are presented with research materials from both scientific journals and conferences devoted to the PM field.

Over the last two decades the Internet has been a very important communication channel. Last several years, a list of the most popular blogs on many different topics in the Internet is published. At the beginning of 2014 the ProjectNewsToday.com Blog published the list of the 25 most popular Blogs during the last year. In that study researches analyze last ten topics from ten blogs published at the end of 2013 (a table with detailed description and links is placed in the appendix).

Presented topics are described from the perspective of drawing the points of the research literature in the field of PM which was published in last decade. A definition of the research agenda is explained in the methodology part. The following topics are covered: History of blogging and blogs; Project Management Challenges, Project Manager, Projects and Leadership, Project Management and Information Technology.

The topics are very attractive for researchers. All topics are developing/changing very fast. Each year several new models and good quality books coming on the market. Before discussing the results of the analysis and offering some recommendations, the article firstly presents short history of blogs and the author research method.

2. HISTORY OF BLOGGING AND BLOGS

History of blogging begins in 1990s; blogs are place/virtual space where people share their interest, hobbies, and thoughts online. The main goal of blogging is online self expression. During time blogging became profitable business. In the last decade very profitable sales offers in blogging business have appeared.

Except for individual use, companies also saw the value in blogging. The companies use blogs to present their leadership, social responsibility and an expertise thought. Nowadays blogs are part of company's social media channels usually for external communication.

Many different factors have contributed to growing interest/influence of blogging in the business world. For example, the evolution of search engines in the Internet, made the Internet's content an important tool for measuring the visibility of companies' brands. At the beginning, sharing a new post was much harder, but when other social networks appeared it became much easier. On the one hand social networks support promotion process of the blogs but on the other hand they give chance much bigger amount of communities can express both their interest and thoughts; that means, creating broader competition.

Project managers use the blogs to share experience, promote new book and develop new ideas. All these activities are guided with the objective of improving business environment. The blog as a tool and the blogging as a communication channel help managers to easily show their expertise and present themselves to much broader community.

Many interesting statistics and other information about the blogs and the blogging can be found at: http://socialmediatoday.com/ and http://www.jeffbullas.com/, in the references are a list of several direct links to interesting perspectives. As mentioned in the introduction and deeply presented in the methodology part; the main idea of the research is to explore: what are the main issues covered by the most popular Blogs in terms of the project management? What are the authors' profiles of the Blogs articles on the project management topics?

3. METHODOLOGY AND RESEARCH AGENDA

The research starts with an analysis of the contents of the most popular blogs of 2013. Over the last year, the blog posts (articles) have been published weekly, monthly, quarterly, or with different frequency, in a total of approximately 600 articles. Our first task is to identify, among those 600 articles, those that could be an interesting stream to follow on the PM topics. Furthermore, research will follow the framework/content of last ten topics of each blog from the list of the 25 most popular blogs in 2013. The search resulted in 100 articles, which included many different topics on the project management.

The next task was to conduct coding of the titles. The coding was guided with an idea of indentifying whether each of the 100 articles was actually concerned with the PM. The coding is important due to provide us with topics that later are describe on the basis of the referent research literature. The exact titles and the coding are presented in the appendix (Table 1.).

The summarizing of an article was decided upon reading only its title. When the title was not clear enough, the full article was explored and the final decision was made afterwards. The final database of the content analysis includes 95 articles, as listed in the appendix (Table 1.).

The next idea was to answer our second question: What are the authors' profiles of blog articles on project management topics? The research tested the following ideas. The information was collected on the 15 individuals who authored the 95 articles. Firstly, blog authors were classified according to either academic (university degree, book writers and lecturers) or professional (project managers, consultants, analysts and others) profiles. Secondly, the research explores the involvement of the authors in the general PMI or IPMA activities/certification. To do so, we built the publication profile of the 15 authors by searching for a name of each author and checking the professional web presentation. The links to 90% of authors' profiles is given in the appendix (Table 1.) 05.03.2014 year (Date when links are checked). The research question/concept (the author profile) is explored and presented briefly, due to limits of the conference paper requirements. In the following chapters the answers on the first research question and the topics that bloggers mostly discuss at the end of 2013 are presented.

4. PROJECT MANAGEMENT CHALLENGES

The project management (PM) concept characterizes many challenges. In chapter we focus on: complexity, risk and uncertainty (Lechler, Edington, & Gao, 2012; Jaafari, 2001; Loch, DeMeyer, & Pitch, 2006; Saynisch, 2010; Shore, 2008; Maylor, Vidgen, & Carver, 2008).

How will the world develop in the future? The answer would require a special prize. What is more, the answer for the question which techniques will contribute to the future development of the world is quite obvious – the PM is both current and future business advantage. Therefore, the complexity of projects is constantly increasing (Saynisch, 2010). At the same the world is time rapidly growing and developing. Hence, business complexity follows those trends and classical knowledge loses ability to master —complexity" challenge (Cicmil, Cooke-Davies, Crawford, & Richardson, 2009).

New lights are already with us; both new technologies and social improvements are proposing different ways to overcome or simplify current and future challenges (Saynisch, 2010). The different research subjects from

both the natural and social science (e.g. evolutionary and chaos theory, self organization, synergetic, brain research, social systems theory, theory of complex systems, etc.) gives managers new alternatives to find better solutions (Saynisch, 2010). In the studies (Saynisch, 2010) the world class researches in the modern natural and social scientific theories take the challenge to recommend new models as they define —Beyond Frontiers of Traditional Project Management". Thus, the research target was the applicability of modern theories in the PM context.

The current classical PM knowledge is structured on —mechanical, mono causal, non dynamic (static), linear structure and a discrete view of human nature and societies and their perceptions, knowledge, and actions. It works on the basis of reductionist thinking and on the Cartesian/Newtonian concept of causality (the mechanistic science)" (Saynisch, 2010). Therefore, the classical PM needs both new assumptions and paradigms for future development of society.

A contingency approach could be an alternative for decreasing complexity in the PM practice. Therefore, the idea of contingency approach is opposite of almost Tayloristic model —one-size-fits-all" to management practice. The contingency idea gives freedom to the managers to explore entire situation or a project challenge context (Maylor, Vidgen, & Carver, 2008). Moreover, to understand better and simplify the PM complexity it could be divided according to structural (number of elements and interdependence of elements) and uncertain issues (goals and methods) (Williams, 2002).

In the recent research (Lechler, Edington, & Gao, 2012), there are discovered both risk and uncertainty of the PM concept. The researchers discuss the challenge as dilemma of definition between those two topics (Lechler, Edington, & Gao, 2012). The importance in a context of educating project managers is especially emphasized (Lechler, Edington, & Gao, 2012).

The projects are unique by definition and project uncertainties are imminent, regardless how much information is collected before a project is proposed (Hubbard, 2007; Sydow & Staber, 2002). When the economist debate on the uncertainties; they conclude it is the necessity for the possibility of convenience. Hence, with reference to several studies, the uncertainties are not inevitably defined to pessimistic issues, sometimes interpreted as synonyms for risk (Jaafari, 2001; Loch, DeMeyer, & Pitch, 2006; Lechler, Edington, & Gao, 2012).

The PM methodology endeavor many tools for both predicting and counting the project risk, but in the case of the uncertainties alternatives are very narrow and often just negative opportunities are visible (Lechler, Edington, & Gao, 2012).

5. PROJECT MANAGER

The earliest human societies, as Greeks, Romans and Egyptians used the PM techniques to build both working and living environment. The researches Walker and Dart (2011) take up that issue and present the following examples: the Great Wall in China, the pyramids and magnificent urban structures such as temples, administration palaces etc. Moreover, the researchers create an idea of similarities in style, order, decisions and compare ancient leaders and contemporary managers: focus of the leaders in Roman time was on —get things done"- focus of the contemporary managers is on optimization and efficiency.

First lights on the PM topic came from construction, shipbuilding, aerospace and manufacturing projects as cases of projects - they attract a —scientific" view on operations management influence (Walker & Dart, 2011; Turner, Huemann, & Keegan, 2007). Therefore, those projects could be defined as —engineering" type of projects. Hence, even in contemporary practice of the PM that early start style is recognizable.

Outsourcing is an idea that has very positive influence on developing the PM practice. Moreover, it interesting is that the idea is with us from the Romans projects practice - they used to outsource most of maintenance and construction work to private companies (Walker & Dart, 2011). Furthermore, knowledge management and knowledge sharing alike have some lights in Romans the PM practice (Walker & Dart, 2011). Both the outsourcing and knowledge management models shift very positively the contemporary PM leadership practice.

Nowadays, we are dealing with constantly changing business environment. Changes in culture and technology have revolutionized opportunities for the PM techniques and it is necessary to develop to take up new challenges (Walker & Dart, 2011). The PM environment is different than classical day-to-day operations environment (Turner, Huemann, & Keegan, 2007). Over last 20 years the PM literature have changed attention from technical to people oriented, especially in classical human resource management context (Turner, Huemann, & Keegan, 2007). Moreover, the development of both technology and power/information sharing give an additional shift in the PM practice and science (Walker & Dart, 2011).

6. PROJECTS AND LEADERSHIP

Practice of the PM in the 21st century is facing a challenge of doing business in very dynamic and fast changing environment (Tyssen, Wald, & Spieth, 2013). Implementation of the PM methods is growing almost in any industry (Sydow, Lindkvist, & DeFillippi, 2004; Bakker, 2010). The course change from standard to temporary organizations is one of main discussion streams in the PM literature and the practice (Tyssen, Wald, & Spieth, 2013).

The standard (contemporary) organizations setting assumption is somewhat stable and continuous organizational environments. The temporary organizations require flexibility, cross-disciplinary integration, short-term orientation, limited duration, unique in terms of tasks etc. (Tyssen, Wald, & Spieth, 2013). Therefore, a leadership approach of 21st century needs to change and adapt in order to serve better new business challenges.

Contemporary leadership theories are focused on relationships, interaction and subjective perception (Yukl, 2012; Bluedorn & Jaussi, 2008). Temporary leadership may require a different paradigm as a result of different business environment and perception of the leadership alike, as important factors for project success (Tyssen, Wald, & Spieth, 2013).

The temporary organizations require a different team approach. General team characteristics are similar as in the contemporary organization but the team approach is different. A team is a unit of two or more employers, who are capable and have the same purpose, mission, objectives, and expectations (Lussier & Achua, 2009). The team approach of the temporary organizations requires —carrying out time-limited undertakings and disperse upon completion; paving the way for a joint course of action with the goal of completing a non-routine task; often accompanied by non-routine processes and uncertain working conditions; whereas complexity in terms of roles and participant backgrounds is often caused by a variety of different experts working together" (Tyssen, Wald, & Spieth, 2013). Therefore, the temporary team deals with higher uncertainties and risks in terms of tasks, activities and processes.

Most of the PM literature is based on assumptions from construction/engineering industries. The main ideas are focused on —planning" and —structuring" (Zwikael & Unger-Aviram, 2009). The PM concept in the last several decades slowly has been changing the course of both the practice and the literature to a broader concept. New concepts draw the new models with softer leadership style and it requires further studies (Tyssen, Wald, & Spieth, 2013).

Five main characteristics of the temporary organizations are: *Temporariness; Unique Outcome; Missing/Ambiguous Hierarchies; Heterogeneity of Team Members; and Changing Work Teams* (Tyssen, Wald, & Spieth, 2013). Hence, one of main questions for further research is: how does leadership take place in these new environments?

7. PROJECT MANAGEMENT AND INFORMATION TECHNOLOGY

The histories of development of the Project Management (PM) and Information Technology (IT) show significant relationship and influence on each other. The PM started to shift the market after establishing the PM associations in 1960s. The PM and the IT subjects connect points for many other business and academic areas, as finance, construction, marketing, sociology, culture, politics etc. (Rivard, & Dupré, 2009). Moreover, in January 2006, between 15-20% of members in the PM association (PMI) were coming from IT industry or working in companies that produce software (Rivard, & Dupré, 2009). However, nowadays popularity of the information technology projects (ITP) is decreasing due to low success of implementing and general crisis on the market (Pratt, 2012). Additionally, education of ITP manager is one challenge in the ITP subject (Pratt, 2012). The PM knowledge base needs to adapt both new skills and techniques in order to serve the ITP requirements (Pratt, 2012).

An initial company's reaction or action on the changes at the market is research projects (R&D). As a consequence of the R&D project companies build new services, models and innovative solutions (Brocke & Lippe, 2013). The R&D projects are usually organized as collaborative research projects between academic, public and business partners (Brocke & Lippe, 2013). Moreover, in the study (Rivard, & Dupré, 2009) is presented a content analysis of the Project Management Journal (PMJ) from 1988 to 2005. The outsourcing projects as a subject is not covered and the authors recommend the topic as a gap for future research.

Currently, multi partnership on the R&D projects between above mentioned partners is very common. Reasons for collaboration are different: economical, scientific, innovative and social (Todeva & Knoke, 2005; Etzkowitz, 2003). Therefore, many stakeholders show interest to fund these R&D projects (Brocke & Lippe, 2013).

8. CONCLUSION

The described topics are presented in three thematic parts of the article. Firstly, research start with an historical overview of both terms the project management and the blogs/blogging. Secondly, research describe challenges which each of the topics faces in contemporary business environment. Lastly, research present short answer to the interesting question: What are the author profiles of Blogs articles on the project management topics?

The third part of the article or the above mentioned question opens many different opportunities for exploring. The research uses an alternative and in short presents that the authors of blog articles are both very experienced and business oriented. Furthermore, power of both bloggers and blogging is constantly growing (many examples of powerful influence of blog posts (articles) on different companies‘ campaigns could be easily found on the market). Therefore, research calls researchers to come with more creative ideas and bring new paradigms from emerging blog business.

The research literature is rich with many different topics. Both practice and science are agreed that experience is very important characteristic of the project manager or a project management researcher. Building the profile of the most popular blog authors draw a new picture on type of information that could be read in the blogs in future. The topics covered in the research are the most popular topics covered by bloggers at the end of 2013. As a result of research conceptualization in general terms and research requirements to create a new research in accordance with referent literature; blogger posts are alike the inspiration source for the research.

The reader could ask now at the end: Why does the research focus on topics such as Project Management and Information Technology, Projects and Leadership, Project Manager, Project Management Challenges; it is a result of the bloggers posts which are focused also on the topics at the end of 2013, as presented in the table 1. in the appendix and in the methodology chapter. The research conclusion is guided from the perspective of closing the answers on the main research paradigm. The main research paradigm follows the concept that each topic is presented from the perspective of leading challenges that researchers found in referent PM research literature. Therefore, the summary of each study topic is formed as a chapter of the research and its conclusion is back on the research questions and the summary of beginning idea of the research.

The research has a vision that the article is just the beginning of exploring the challenge. Exploring many other aspects similar to blogs (e.g. websites, news, slideshare, linkedin, etc), researchers found it very inspiring.

9. ACKNOWLEDGEMENTS

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11. APPENDIX

Coding summary: Project Success, Value of Value, Project Management Office, Project Team, Project complexity, Leadership, Project Management Careers, Project Management Training, Project Management Challenges, Social Media in Project Management, Online Project Management Software, Agile Project Management, Project Strategy, Project Failing, Project Management and Learning, Project Stakeholders, Pilot project, Big Picture, Project Lifecycle, Project Elements, Project Management Models.

Table 1. Presentation of research links, topics coding system, and blog author's profile

Blog name, blog topics	Coding of topics	Description of author profile
1. Herding Cats 1. Probability of Project Success. 2. 8 Reasons Why Estimates Are Too Low 3. Quote of the Day 4. How Not To Develop What "Done" Looks Like 5. Project Management and the Three Body Problem 6. A Seat At The Table 7. Seven Immutable Activities of Project Success 8. Elements of Project Success 9. Quote of the Day 10. Quote of the Day	Project Success. Project Success. Project Success.	Link to linkedin profile: http://www.linkedin.com/in/glenballeman?trk=btn_typepad Very Experienced Business oriented Professionals Book writer Business degree
2. PMI Blog - Voices on Project Management 1. Determining the Value of Value 2. Running a Marathon, Running a Project 3. The Must-Haves of Establishing a PMO 4. Setting the Stage for Order 5. Multi-Project Schedule Planning, Part II 6. Ways to Build Strong Project Teams 7. Dealing with Difficult People 8. Tips for Sustainable Change Management 9. Translation Series: "Gen Y: Driving Lessons Learned" 10. Bloggers Sound Off: Navigating Complexity	Value of Value. Project life cycle Project Management Office (PMO) Multi-Project Planning Project Team Project Team Change Management Project complexity	Certificated Experienced PMI Blog Professional association Professionals Business degree
3. QuantmLeap 1. Some Notes re. Complex Systems 2. Why We Need Bureaucracy 3. Project Status Report You Are Not Likely to Come Across – Part 3 4. My Core Values 5. On Leaders and Leadership 6. A Note to Employment Agencies 7. Quote of the Day – About Bureaucracy 8. Doing Agile vs Being Agile 9. 10-Point Checklist for Assessing the Believability of a Claim 10. Quote of the Day – About Freedom	Complex Systems Need Bureaucracy Project Status Core Values Leadership Project team Bureaucracy Agile project M	Link to linkedin profile: http://au.linkedin.com/in/shimmarom Certificated Experienced Business oriented Business degree

4. Arras People - How to Manage a Camel 1. Q&A Project Management Careers: The Counter Offer 2. Adventure, Project or Business as Usual (BaU)? 3. It's in my cover letter 4. What does project management mean to me? 5. Tailoring for Specific Roles 6. A Date with Dennis Lock 7. Top Ten Tips for Becoming a Successful Project Manager 8. Project Management Gif Party 9. Psychology and Project 10. Management Project Management Rowing Boat Challenging UK Government	Project Management Careers Successful Project Manager Psychology and Project Management	Link to profile: http://www.arraspeople.co.uk/about-arras-people/more-about-arras-people/ Experienced Business oriented Professionals Certificated Business degree
5. Virtual Project Consulting 1. Do you know the ROI on your Corporate Training? 2. Nelson Mandela – One of the Biggest Leaders in Modern History 3. Project Management – Challenges we look forward to 4. A Project Turn Around – it's all about Relationships 5. Expand Your Business Potential at the Microsoft Convergence Conference 6. What does Project Management mean to me – a Project Manager's sermon 7. How Social Media is bringing Project Managers together 8. Practical use for Social Media in Project Management 9. Practical use for Social Media in Project Management 10. Practical use for Social Media in Project Management	Project Management Training Leaders, Leadership Project Management – Challenges Project Relationships Project Management Careers Social Media in Project Management	Link to profile: http://www.virtualprojectconsulting.com/about/ Experienced Business oriented Professionals Certificated Business degree
6. Zilicus 1. Online Project Management Software 2. Why Project Risk Management Tool Is, Must-Have For Organizations 3. Lesser Chaos, Better Project Resource Planning 4. 16 Things That a Good Project Manager Knows and Practices Regularly 5. Early Preview of Online Project Management 6. Agile Project Management, 7. Project management software, 8. Improve Work Management and Project Collaboration	Online Project Management Software Project Risk Management Project Resource Planning Preview Project Management Agile Project Management Project Collaboration	Link to profile: http://www.zilicus.com/aboutus/team/ Experienced Business oriented Professionals Business degree
7. The Tao of Project Management 1. No Win/No Lose 2. Appearing Foolish 3. Owning or Owned 4. Gentle Intervention 5. Creative Energy 6. Disturbing Wisdom 7. Meditation 8. The Root of Things 9. Virtuous Leadership 10. Doing Little	Project Strategy Leadership	Link to profile: https://www.blogger.com/profile/01209241018488058934 Experienced Professionals Business degree Book writer Business degree
8. ProjectManager.com 1. Project Manager Career Boost 2. The Pros and Cons of Remote Project Management 3. Playing the Blame Game 4. Why Your Project Might be Failing 5. Why You Need Online Project Management Software 6. 5 Reasons to Keep Learning 7. What Sort Of Team Do You Have? 8. Top 10 Team Building Ideas 9. Tips For A Stress-Free Vacation 10. How To Reduce Time on Projects	Project Manager Career, Playing the Blame Game Project Failing, Online Project Management Software Project Management and Learning, Project Team Time Management on projects	Link to profile: http://www.projectmanager.com/about-us.php Experienced Business oriented Professionals Business degree
9. Ron Rosenhead 1. They threw it' away 2. Are lessons learned – not really? 3. Are people skills the final project management frontier? 4. Strategies for Project Sponsorship 5. Stop that project roll out – ensure you pilot it first. 6. Getting more for less requires engagement to succeed. 7. –The perception is different from the reality" 8. We'll learn from that – but will you and will the company? 9. How often do you take the helicopter view? (Big picture) 10. What does project management mean to me?	Project Management and Learning People Skills, Project Team, Project Stakeholders Pilot project Big Picture, Project Manager Career	Link to profile: http://www.ronrosenhead.co.uk/about/ Experienced Business oriented Professionals Business degree
10. Mike Clayton	Project Lifecycle	Link to profile:

1. Project Lifecycle – just for fun 2. Project Planning Poster 3. Simplifying Project Complexity 4. Project Definition: The Layers of an Onion 5. Comparing My Eight Steps 6. Eight Steps to deliver on budget, on target and on time 7. Six Project Management Modes 8. What is a Project Manager? 9. How to Manage a Great Project 10. Periodic Table of Project Elements	Project Planning Project Complexity Project Definition Project Management Modes Project Manager Great Project Project Elements	http://www.linkedin.com/in/mikeclayton Experienced Business oriented Professionals Business degree Book writer

ASPECTS OF PUBLIC RELATIONS AND FINANCIAL MODELS WITHIN NGO'S

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Abstract: *This document presents a unique paperwork on the basics of project and program management in NGO's. Purpose of this research is to present main issues of PR and finance in such organizations, with main focus on student organizations. The lack of formal documents with scientific approach considering online public relations and funding in non-profit organizations motivated three authors to use their experience in non-profits. The aim of this paperwork is to combine different sources of theoretical knowledge in basics of program and project management, online PR, and organization activities and funding of non-profit organization, creating inimitable paperwork useful for people working in non-profits.*

Keywords: *program management, project management, public relations, NGO, finance*

1. INTRODUCTION

The modern era of Project Management began in the 1950s but Project Management techniques can be found as far back as the days of the pyramids.

In the 1950s, businesses such as GE and DuPont realized there were benefits to organizing work around projects and communication was needed across various functional departments and units. There were a number of informal techniques and tools in use, but —projects‖ tended to ad hoc. Tools such as Gantt charts (Henry Gantt (1861-1919) were in use but Gantt charts were not enough to ensure proper control and ensure completion of projects on time and on budget.

During this time period, two mathematical project-scheduling models were developed:

- "Critical Path Method" or CPM
- "Program Evaluation and Review Technique" or PERT
- PRINCE 2

These tools and techniques as well as a number of others spread quickly as businesses looked for new ways to manage large and complex activities, evolving into project management, as we know it today (Anheier, 2010).

2. PROJECT MANAGEMENT

Project management is the process and activity of planning, organizing, motivating, and controlling resources to achieve specific goals. A project is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value. The temporary nature of projects stands in contrast with business as usual (or operations), which are repetitive, permanent, or semi-permanent functional activities to produce products or services. In practice, the management of these two systems is often quite different, and as such requires the development of distinct technical skills and management strategies. If some non-profit organization, such as student organization is project oriented, it is doing its purpose through such projects, where each project has the personal goal that is not connected to the other project (Applied Agility, 2010).

3. PROGRAM MANAGEMENT

Program management or program management is the process of managing several related projects, often with the intention of improving an organization's performance. In practice and in its aims it is often closely related to systems engineering and industrial engineering.

The Program Manager has oversight of the purpose and status of all projects in a Program and can use this oversight to support project-level activity to ensure the overall program goals are likely to be met, possibly by providing a decision-making capacity that cannot be achieved at project level or by providing the Project Manager with a program perspective when required, or as a sounding board for ideas and approaches to solving project issues that have program impacts. Typically in a program there is a need to identify and manage cross-project dependencies and often the PMO (Program or Project Management Office) may not have sufficient insight of the risk, issues, requirements, design or solution to be able to usefully manage these. The Program manager may be well placed to provide this insight by actively seeking out such information from the Project Managers although in large and/or complex projects, a specific role may be required. However this insight arises, the Program Manager needs this in order to be comfortable that the overall program goals are achievable.

There are two different views of how programmes differ from projects.

On one view, projects deliver outputs, discrete parcels or "chunks" of change; programs create outcomes. On this view, a project might deliver a new factory, hospital or IT system. By combining these projects with other deliverables and changes, their programs might deliver increased income from a new product, shorter waiting lists at the hospital or reduced operating costs due to improved technology. Most of non-profit organizations (student organizations) that are project oriented are actually program oriented. Some of these organizations are ESTIEM (European Students of Industrial Engineering and Management), BEST (Best European Students of Technology), AIESEC, etc.

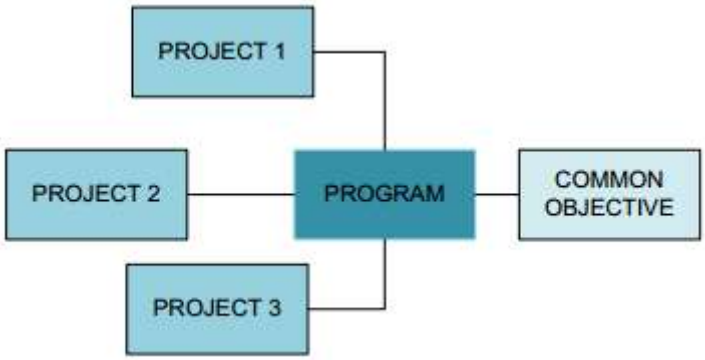

Figure 1. Program management and its connection to projects (Zambruski, 2007)

There are many important things when we talk about managing projects and programs, but there are three factors that are really crucial for the success of the project/program: time, resources and scope and those factors form, so called “Project Triangle” (Zambruski, 2007).

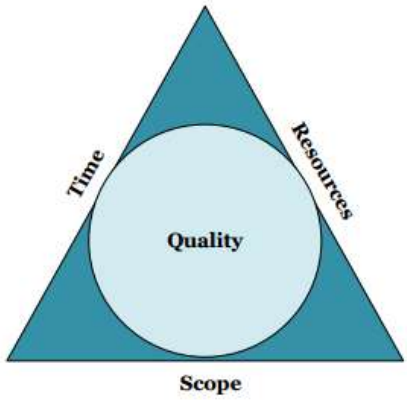

Figure 2. Project triangle (Zambruski, 2007)

Beside project triangle, there are many other things that could help follow the success of the project. Some of those things is a project life cycle.

Project life cycle is —a collection of generally sequential and sometimes overlapping project phases whose name and number are determined by the management and control needs of the organization.

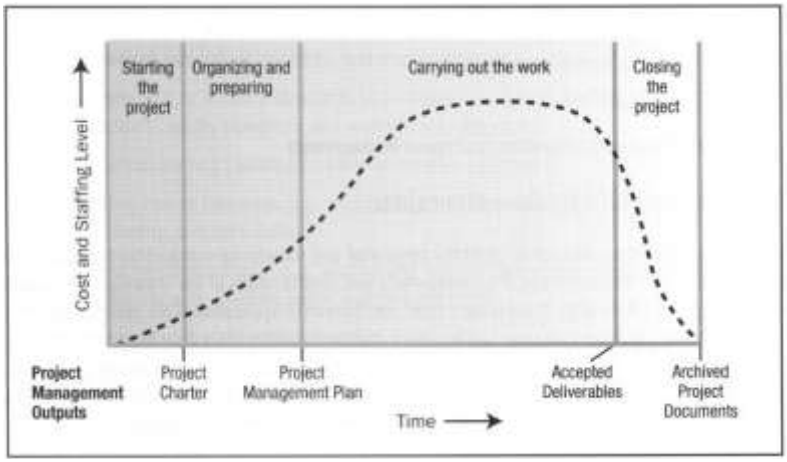

Figure 3. Typical costs and stuffing levels across the project life cycle (Zambruski, 2007)

4. WHAT MAKES A GOOD PROJECT?

There are four yardsticks to measure the quality of a project:

- Is it relevant? Does it really tackle the problem it sets out to address? If the problem, for example, is that the children in the village can't read, is a new school the best answer, or should one look at the parents' attitude to education, the shortage of teachers, the lack of money in the village's budget, the need for labor in the fields, or the government's lack
- of investments in the social sector? Does the project have a credible "entry point"?
- Is it feasible? Is it likely to achieve its objectives? What risks does the project face? What resources – financial and human - does it have? How realistic is it?
- Is it cost-effective? What is the relationship between the cost of implementing the project and its expected benefits? Is there a strategy that would have achieved the same results at lower costs? For example, sending all the children in the village who can't read to an expensive boarding school would probably improve their literacy, but the cost would be immense, and the impact on the community would be very destructive. So building a school might be a more cost-effective strategy.
- Is it sustainable? Can it go on delivering its benefits after the external assistance has come to an end? For example, with there be teachers for the school, money to pay them, parental support, good educational policies from the government – long after the school has been built, and the project has closed down? (Participant's Workbook, 2012)

5. STAKEHOLDER'S ANALYSIS

The "stakeholders" in a project are all the people or organizations who either stand to be affected by the project, or who could "make and break" the project's success. They may be winners or losers, included or excluded from decision making, users of results, or participants in the process. Stakeholders analysis is the mapping of a project's key stakeholders, who they are, what interests they have in the project (positive or negative), and how these interests can affect a project, "make or break" it.

Such a mapping activity will help you identify:

- Which individuals or organizations to include in your "coalition" or network
- What roles they should play, and at what stage
- With whom to build relationships, which relationships to nurture
- Whom to inform and consult about the project

You can use a matrix that would look like the table on the next page.

Table 1. Stakeholder analysis (Participant's Workbook, 2012)

Infuence/Importance	High influence	Low influence
High importance	**Stakeholders who can gain or lose a lot from the project, *and* whose actions can affect the project's ability to meet its objectives** These actors are powerful – you need to develop good relationships	**Stakeholders who stand to gain or lose a lot from the project *but* whose actions cannot affect the project's ability to meet its objectives** These actors lack power – but you need to make sure their interests are fully represented
Low importance	**Stakeholders whose actions can affect the project's ability to meet it's goals, *but* who have little to gain or lose from the project** They may be a source of risk, unpredictable, so keep an eye on them!	**Stakeholders who have little to gain or lose from the project, *and* whose actions have little influence on the project** Just keep them informed.

6. PROJECT STRATEGY

First of all, you need to determine **who is going to benefit** from your project, who will be its beneficiaries. Can you be precise: how many, where are they to be found, what are their social, economic and cultural characteristics? Then ask yourself who will be your partners, not only at the local, but also at the national level. If you have done the stakeholders analysis, the answers should be obvious. Create a network, integrating beneficiaries and partners, that is, make sure they talk to each other. Decide on their roles: how will you communicate with them? What are the lines of authority (this is especially important if you work with other groups who share your objectives, but whom you don't control – they have their own funding and staff)? Who takes decisions? Do you need a steering committee to bring everyone to the table?

Then you need to decide on a **project approach**. There are two types of approach, and they each require a very specific project design. *Direct* support (DS) is one type of intervention, and it means that the project works directly with the beneficiaries (e.g., children, their families, a group such as landmine victims) through the provision of services such as education and training, health care, or construction of shelter. Many projects, however, choose a second type of intervention, called institutional development (ID). Examples are the strengthening of NGOs or government institutions so they can deliver better services to the target group, those children, families or landmine victims. In that case, the NGOs or the government (for example, the national mine action center) are the direct recipients of the project, but the beneficiaries ultimately are the people who get improved services. The advantage of those "ID" projects is that they have a multiplier effect, as eventually more people will be reached. But if the proper institutions are not there to be strengthened, or if they are not interested, direct support may be preferable (Niven, 2008).

7. PROJECT PREPARATION

Before starting a project's preparation, it is important to fully understand the terms which are commonly used in any given project development and implementation. As far as European Union projects are concerned, in here we will use the definition available in Aid Delivery Methods: Project Cycle Management, a manual released by the European Commission in March 2004. The main objective concerning this manual is identification of project intensions. At the beginning of a project's preparation, the project leader should have a clear idea of the problematic situation that needs to be addressed, the improved situation to be reach and the stakeholders who will be directly involved.

Every project can be presented as a sequence of consecutive phases:

1) **The Concept Phase** – During this phase, the complete concept of the project is developed.
2) **The Analysis Phase** – The project's specific objectives, expected results, activities as well as the analysis of the risks which can affect its implementation are defined.
3) **The Planning Phase** – Stakeholders are identified as well as the project's beneficiaries and specific target groups which will be addressed by the project. Furthermore, the resources (financial and human) the project requires should be identified in addition to clear coordination and management arrangements as well as monitoring and evaluation systems.

4) **The Implementation Phase** – The project becomes operational and activities are executed.
5) **The Evaluation Phase** – The implementation of the project's activities is monitored through indicators that have been developed during the planning phase. It is continuous process which might lead to adjustments before a final evaluation, at the termination phase.
6) **The Termination Phase** – The initial assumptions are compared with the project's actual outcomes in order to evaluate the project results and impact and draw recommendations for future actions.

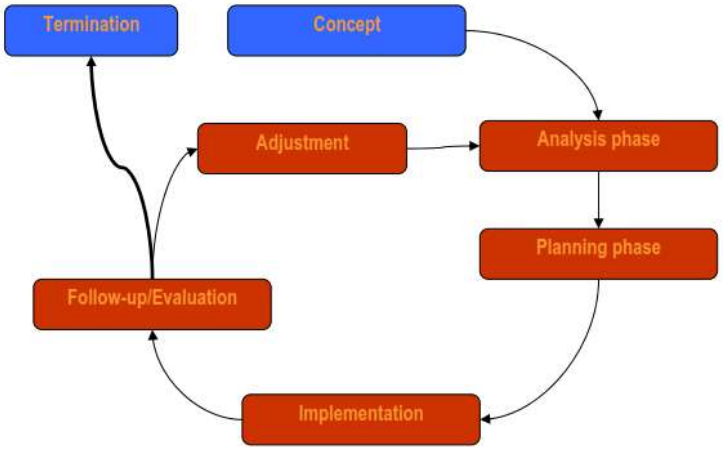

Figure 4. Preparation process in NGO's projects (Participant's Workbook, 2012)

8. MODERN NEEDS OF THE NGO

With the technology development and new business models, NGO's have found a new ways of doing their activities successfully and more efficiently. Viral marketing, but also online public relations have become a standard for this type of organizations, and not to mention companies. Online PR is taking a bigger part of the whole PR by giving better and faster results of promoting the organizations. For example, ESTIEM LG Belgrade (student's organization) has become one of the most recognizable and most active local groups, thanks to the online PR, which has made this organization more attractive to every stakeholder, including companies, institutions such as universities, government, students, etc. Why is this important?

Almost every student organization depends on some institution, because they are non-profitable. That's the reason why NGO's has to have a good PR strategy, focusing on modern aspects of promoting the organization that will bring the organization to the main sponsors, that will provide a donation to the organization. Those sponsors could get in return different types of promotion, getting active in some activities, etc. But there are some sponsors, such as some public institutions that give a funds without reaching for something in return.

9. MODERN ASPECTS OF PUBLIC RELATIONS IN NGO'S

Public relations are the practice of managing the spread of information between an individual or an organization and the public. The term "Public Relations" is often misunderstood especially because people tend to associate it exclusively to media relations. Public relations have started out as media relations, but in the recent years, they have become much more. And, with the introduction of many Internet services, it has also become clear that public relations deserve to be named "communications".

When making a difference between Offline and Online public relations (PR), it is very important to clear out the difference between the terms „Offline" and „Online". Offline addresses the traditionalll way of communicating with target audiences - using traditional, well-established communication channels like printed material (newspapers, magazines), television and radio, press conferences and special events. With the introduction of mainstream Internet usage, there has been a shift of focus for all communication activities, and with the growing popularity of social media, the Internet has taken a primary channel for communicating different messages.

Today, Online Public Relations represent a way of creating identity, and building and increasing the image and reputation of specific subjects through selected Internet channels: social media and networks.

Non-profit organizations have similar goals in promotion and PR just like profit organizations. Creating visibility, building loyalty and trust through positive image and reputation, and creating a stable system of interactions with target audiences with a fail-safe key in crisis situations. Online PR, through a strategic use of social media capacities, helps the members of the non-profit sector to be on the same level (or on a higher one) comparing to entities with profit. By active listening, and conversation encouragement, an active online presence is built, that after some time clearly leads to the accomplishment of PR (and promotion) goals.

Social media defines online media, like text, photos, and messages or video that is social in nature. In other words, media that starts conversations, encourages people to pass it on to others, and finds ways to travel on its own. Social media as a tool cannot be used as a whole. It has to be strategically analysed, and then the right mix of social media tools is to be selected. Creating the social media mix starts with understanding two groups of tools it offers: blogging platforms and social networks.

A shorthand term that means „Web log“ is an online, chronological collection of personal commentary and links. Easy to create and use from anywhere with an Internet connection, blogs are a form of Interne publishing that has become an established communications tool. Bloggers (blog authors) review products, services, public images, they write about organizations and individuals, and address the popular problems and trends. Non-profit organizations often have a similar mission and vision with specific bloggers, and that is a niche that should be recognized and tapped into.

A branch of public relations named „Community management“ is a new trend using the potential of the digital business world. Social networks are a subset of social media, Internet communities allowing interactions between users through a specifically, and in many cases functionally oriented, interface. They allow users to have personal profiles, get in touch with friends, colleagues, acquaintances and business contacts, and share relevant textual and multimedia content with them. On the other side, organizations and specific individuals use different social networks for creating a loyal fan base, conversations, feedback systems, and fail-safe tool in crisis. Top 10 most used social networks in 2014 are respectively Facebook, Twitter, LinkedIn, Pinterest, Google Plus+, Tumblr, Instagram, VK and Flickr.

Using the potential of social networks is done through constant activity on organization’s profile pages. Starting, developing, and sustaining the conversation with different members of the target audience enables the creation of a dynamic feedback system, loyalty building, and image and reputation development. Besides reaching the traditional public relations goals, Online PR for non-profit organizations works in the fundraising sphere, events promotion sphere, and as active contributing factors to advocacy and recruiting and engaging volunteers.

Enormous success of online public relations, created a huge amount of interactions on social networks. In the manner of good PR practice, interaction on social networks should be continuous, on-time and useful for our audience. Therefore, that kind of demand created a new job position in PR sectors called community manager. The purpose of community manager is to monitor, participate and engage on social networks of his company. This position does not have non-working days, according to successful implementation of constant interaction. Also, one of the most important parts of community management is careful monitoring of social networks, not only those on which one organization presents itself, but every network that has potential customer or audience.

Although everything above is particularly important for a community manager to do, without engagement, none of those activities will have visible improvement of communication. The engagement is the activity that creates a community around the organization, a wide group of people committed to an organization. And it’s about building communities which really means building relationships. The engagement is an activity that requires the most time spent on this position, but the only one that gives positive result on communication organization towards its audience.

For non-profits, good community manager is essential part of online public relation. Due to exponential growth of internet users, and lack of finance, internet with the social networks gives sustainable solution for communication between organization and people in both ways. To attract people to hear them, community manager usually post interesting news, encourage interaction with comments and mutually sharing. Community manager is the person, who has to present his company to people as their friend, with all its virtues.

As every process in management, evaluation presents an important segment in detecting the strength of simpact on public relation. Evaluation of online PR effects is much easier due to huge amount of online tools

for tracking and monitoring. A number of good keyword research tools are available without charge. Leading free tools include Google Keyword Tools and SEO Book keyword tool.

Online public relations have a traditional purpose when talking about non-profit organizations. The goals of public relations concerning identity, image and reputation are achieved through regular communication with all of the target audiences .What differs the Online public relations of non-profit organizations from the profit ones, is the unique nature of the community management. Combined with the interactive approach to dynamic social networks maintenance, it creates a good environment for fundraising and advocacy activities, approaches, and systems for volunteer management. (Đorđević and Ignjatović, 2012)

10. FINANCING OF NGO'S

NGO funding can vary by source, terms, and the type of organization funded. There are several different kinds of foundations and individual donors who provide NGO financing. Some give donations while others reward funds via a grant application process.

Two overarching types of NGO financing are restricted and unrestricted funds. Restricted funds must be earmarked for a specific purpose as dictated by the donor. The only typical requirement for unrestricted funds is that they be used to help the NGO accomplish its mission.

Restricted funds are often specific to a type of project or other need that is outlined during the grant application process. Typically the overall required focus is dictated by the donor, while the NGO can determine the specifics that apply to its particular needs. There may also be restrictions as to how or when the money will be spent once it is awarded.

Unrestricted funds can be an important part of NGO financing as they may be used to fill whichever need is most urgent. Often they will be used to cover non-specific operational and other ongoing costs that are usually difficult to fund with grant money. Common sources of unrestricted funds include donations from the general public, money earned by the NGO selling products or offering services, and institutional funding.

Self-financing is one of the options that a nonprofit organization has to develop a more diverse income stream. It can also help to support programs and cover expenses that donors and grant makers do not want to fund (Zarinpoush, 2006).

Figure 5. Benefits resulting from self-financing (The Sustainable NGO, 2014)

The universities encourage student organizations to raise funds and sell their projects to the local companies, enabling them to contribute to the University's rich environment.

Self-financing require preparatory work, necessary before the organization can decide whether selling projects and services for a profit is an option that has chances to succeed.

The preparatory work involves market research and analysis of core competence. The preparation requires special knowledge and skills from those that will conduct these activities.

Figure 6. Preparatory work that NGOs will have to perform (The Sustainable NGO, 2014)

In the time of economic crisis, government grants budgets are reduced, as well as municipalities. Funding from universities and faculties do not have to be reduced compared to the previous years, but certainly the financial situation of the organization may be affected, if the faculty budgets are reduced as consequence of lover government dotation to the university.

Therefore, it is necessary to find companies and individuals willing to invest in student organizations and their projects, which benefit both NGO, by receiving more funds, and companies, by recruiting new interns or employees and through marketing and promotion in the public and especially at the university level among students and professors (Rouson, 2010).

11. CONCLUSION

It is predictable that, within the next decade, the Internet will exist as a seamless fabric of classic networks and networked objects. Content and services will be all around us, always available, paying the way to new applications, enabling new ways of working; new ways of interacting; new ways of entertainment; new ways of living. In such perspective, the conventional concept of the Internet as an infrastructure network reaching out to end-users' terminals will fade, leaving space to a notion of interconnected "smart" objects, forming pervasive computing environments. The Internet infrastructure will not disappear. On the contrary, it will retain its vital role as global backbone for worldwide information sharing and diffusion, interconnecting physical objects with computing/communication capabilities across a wide range of services and technologies.

All of that affected on the activities of the NGO's that are mostly project or program oriented, which means that they have various types of projects focused on one or more target groups. Those organizations must have a strong connection, but also a balance between public relations and finance. Only with the good balance of those two departments, organizations will manage to get bigger and attractive to its stakeholders. Beside everything, this paperwork has focused on financial and PR activities, but every NGO should have other departments such as human resources, corporate relations and others in order to have a strong organization.

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