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CONTENTS

WORD OF THE EDITOR

On the occasion of celebrating an important anniversary of the Serbian Project Management Association (YUPMA), its 25 years, we are proud to launch a Serbian Project Management Journal, a specialized journal that is to present the most recent knowledge in the fields of project management and other specialzed management disciplines.

The development of project managemnt in Serbia, since its beginnings in 1970s, to the establishment of the Project Management Association in the 1980s, until today, went through many a difficulty. Regardless of severe problems that this country and the Project Management Association encountered, project management gradually developed and was implemented in this country, and today it is evident that the implementation of project management is a sine qua non in almost all the areas of human life and work.

It is our genuine wish in launching this journal to contribute to the further project management development and implementation in Serbia.

Petar Jovanovic

President of Serbian Project Management Association YUPMA

2

STRATEGIC AND OPERATIONAL ASPECTS OF PROJECT MANAGEMENT

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Abstract: The traditional project management is under the pressure of the need to abandon dealing with individual projects in favour of dealing with a number of projects and focusing upon the goals of the entire organization. Hence it is necessary that the operational aspects of the traditional project management be exchanged for a strategic aspect, necessary if the organizational goals as a whole should be taken into consideration. This is what this paper primarily focuses upon, also taking into consideration the project goals and the benefits gained, as well as the period of the project exploitation, which further brings new aspects into the analysis and implementation of new project management concepts. In addition to organizational goals, strategic aspects of project management stress a long-term perception on the period in which the project exploitation benefits are gained, as well as a broader circle of project users, i.e., the project beneficiaries in a long-term period of project exploitation, especially characteristic of capital projects. The project exploitation period, analysis of the project from the aspect of a broader circle of beneficiaries, and customer and other stakeholders satisfaction add to the range of possible goals and benefits and provide basis for the development of modern project management concepts.

Key words: Management, Project, Strategic goals, Operational goals

1. INTRODUCTION

An overwhelming implementation of project management in nearly all areas of human life and activities and an almost universal approach according to which "everything is a project" has resulted into a shift in the manner project management is used, the goals it tends to achieve and the methodological approaches in its implementation. The initial definitions and principles on which the basic or traditional project management approach is established are not sufficient any longer. The traditional project management is still an operational discipline oriented towards an efficient completion of a given project. And it is here that the operational aspect of traditional project management ends – at an efficient completion of the project and in achieving the planned objectives in the project realization.

Accomplishment assessment of the project management implementation in the execution of a given project is related to the period of planning and execution of the project as well as to achieving the set goals important for that period. Here the basic goals of project management are to complete the project in a given time period, with a minimum consumption of resources and at minimum costs. This is the operational approach that concentrates upon an operational execution of the project as well as upon achieving the goals set for the project. No attention is paid to other projects and their own goals, nor upon the goals of the organization. Rare are the situations, however, when the organization is engaged at only one project and therefore can concentrate on the goals of this project only. It is usually a number of projects that are interrelated in a higher or lesser degree and their realization affects the organizational goals in different ways (Jovanovic, 2008).

Hence it is necessary that the operational aspects of the traditional project management be exchanged for a strategic aspect, necessary if the organizational goals as a whole should be

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taken into consideration. This is what this paper primarily focuses upon, also taking into consideration the project goals and the benefits gained, as well as the period of the project exploitation, which further brings new aspects into the analysis and implementation of new project management concepts.

2. PROJECT MANAGEMENT – FROM OPERATIONAL TO STRATEGIC ASPECTS

The traditional project management is under the pressure of the need to abandon dealing with individual projects and the efficient execution of an individual project in favour of dealing with a number of projects and focusing upon the goals of the entire organization interested in the realization of these projects, in accordance with its strategic objectives. The need to pay attention to organizational goals is increasingly present in case of individual projects too. From an operational discipline oriented towards an efficient completion of a given enterprise, project management makes a link with strategic goals and options and develops into an integrated discipline whose aim is to achieve overall organizational goals (Jovanovic et al.,2010b).

Most frequently, organizations carry out a number of projects simultaneously, hence it is

necessary that these projects are coordinated and oriented towards organizational goals in order that the best possible overall business results be achieved. However, there is an increasing belief that in individual projects, too, the strategic goals of the organization should be taken into account in addition to the goals of this one project itself. This means that it is necessary that a strategic aspect of the organization be in a certain manner taken into account and linked to the operational execution of the project which in turn takes into account the strategic goals. Thus strategic management and project management become connected at both the strategic and the operational levels.

The basic procedure of the strategic management refers to defining the vision, the mission and the strategic goals the organization follows on its way to the future and to

promotion of its vision (Jovanovic, 2007) Defining adequate strategies means determining the methods in which the strategic goals are to be achieved, while individual projects and programmes mean the operationalization of the strategy in the sence of its implementation (Figure 1).
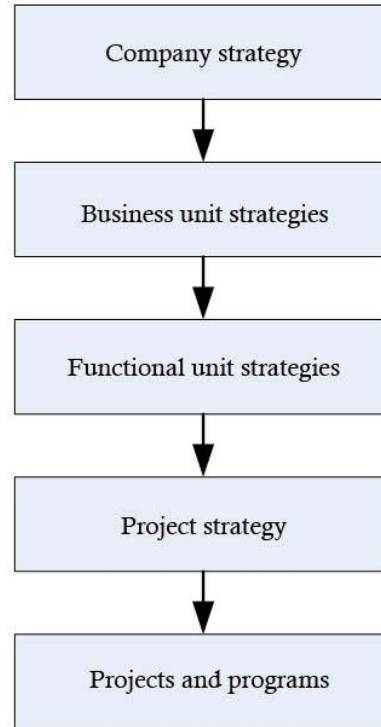
Figure 1.

It is in this way that a connection is made between a strategic aspect of the organization and the operational activities whose realization helps achieve favourable results for the entire organization. There is a clear connection between the vision, the mission, and the strategic organizational goals, on one side, and the individual projects and programmes meant to realize the set strategic goals, on the other. The organizational strategy (business strategy) most frequently consists of individual strategies defined by certain sectors in the organization (strategic business units), so that the organizational strategy becomes a set of individual projects and programmes to be analysed, selected and approved of to be realized. This is where the project manager comes in to ensure the operational execution of

individual projects; however, now it is necessary that all these should be employed in the realization of the organizational strategy, i.e., the achievement of the strategic goals of the organization (Jovanovic et al.,2010b).

The implementation of strategic management in the development of strategic management and achieving desired goals requires that an efficient method of implementing one or a number of strategies be defined in the strategic plan of the organization. The solution is found in the implementation of project management, an operational management discipline that allows for an efficient realization of varied tasks and enterprises.

The project approach, as well as the project

 management concept in general, can be efficiently implemented in all the subprocesses of strategic management. The project organization and project teams led by the

project manager can be successfully employed in strategy implementation and in defining an adequate organization for the strategy implementation. Similarly, in strategy realization planning, monitoring and control the systems of global and operational planning and project execution monitoring are implemented. Generally speaking, project management allows for an operational implementation of strategic management and the realization of individual enterprises resulting from the strategic management subsystems.

A defined and adopted organizational strategy is a basis for defining the project management strategy and concept to be employed in the process of strategy implementation, as well as in a further development of the practical procedure of project management implementation (Figure 2) (Jovanovic et al.,2010b).

Figure 2. Relatedness between the organization and the project management strategy

Having in mind the above said on the strategy implementation and the strategic management and the project management relationship, a global review of the relatedness of the strategic and the project management can be presented,

from the organizational vision to individual projects that exist in the organization and are defined for the purpose of achieving the organizational strategic goals (Figure 3).

Figure 3.

And although the achievement of the strategic goals of the organization is in a way a topic of the program management and the project portfolio management, bringing together the realization of an individual project and the strategic goals of the organization is especially focused upon in the new concept of the strategic project management.

3. STRATEGIC ASPECT – PROGRAM MANAGEMENT AND PROJECT PORTFOLIO MANAGEMENT

In a host of situations in practice there is a number of interrelated or non-related projects an organization has to accomplish, as well as situations in which there is one rather big and complex project that entails a number of subprojects. Such situations cannot be successfully managed by one project manager, with one project team and a classic project management concept. These situations require a new approach, a new concept, and this is program management.

Program management is a new approach in the development of project management, one that is implemented in managing various projects and business and other enterprises. As well as project management, program management can be said to stem from military issues and the development of this concept is associated with complex programs of large army systems realisation (Jovanovic, 2008).

Program management emerged with projects becoming ever larger and more complex as well as connected and interdependent in various ways, which called for a new managerial and organizational approach, somewhat different and more complex in comparison with project management. Program management has been developed as a need to overcome the complexity of managing certain enterprises that involved a number of relatively independent projects, where the basic concept of project management was not able to produce the desired outputs, primarily due to the program scope and complexity and to the number of people involved in the program execution, but also due to the need to use the scarce resources available in an efficient manner.

The term program in program management means a large and complax enterprise which consists of a number of projects or subprojects, where each subproject refers to one aspect of the enterprise that is treated as a program. Thus program means a complex enterprise entailing a number of projects oriented towards achieving the integral goal of the program. Each project has a result or a goal it tries to achieve, however, all the projects are interlinked and oriented to the common goal of the program.
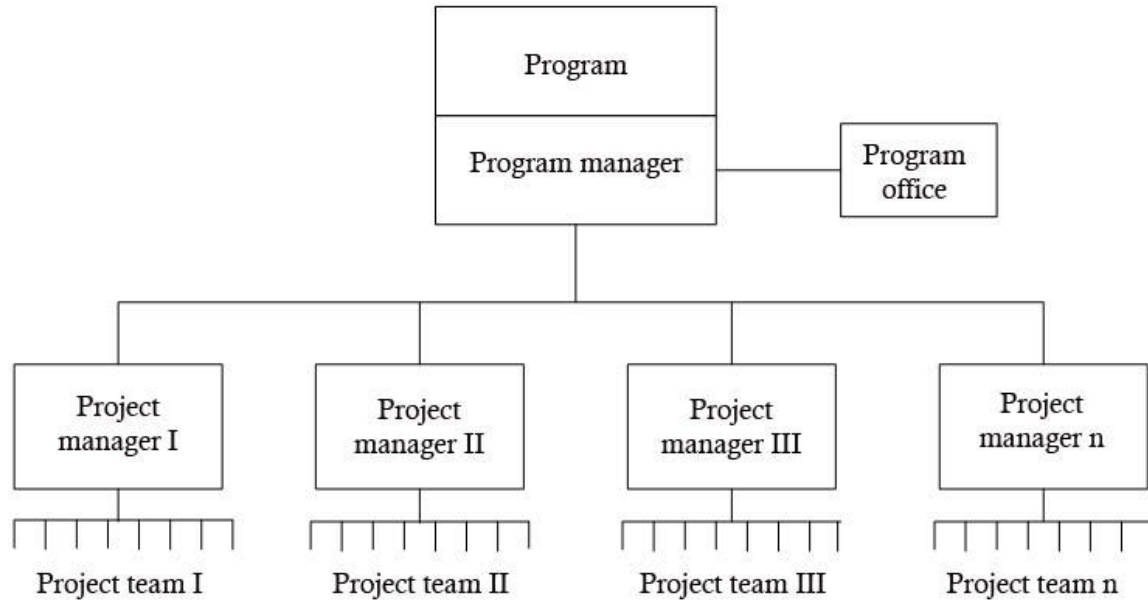
Figure 4.

The project is restrained both in time, in resources and in costs, i.e., managing a project means minimizing time, resources and costs. Each project within the program management has its own restraints in time, resources and costs, however, each of them has its impact and also its restraints as regards other projects, mainly as far as resources are concerned, but also in terms of time and costs. This additionally complicates, even multiplies, the problems in program management and makes the program manager face rather difficult managerial problems (Gereis, 2000).

Contrary to the project management where the focus is on the time of the project execution, program management concentrates upon time and resources. This means that in managing a project, attention is paid to levelling resources and the use of available resources as best as possible. A major concern in program management, on the orther hand, is to involve the existing resources into a number of projects, to allocate them to individual projects in an optimal manner and thus employ them in the best possible manner (Jovanovic, 2008).

Program management is generally described as a developed project management concept where management is exercised on a number of

projects oriented to a common goal or goals. Or rather a coordinated management of a group of projects in order to achieve a set of business goals (Reiss, 2000) What is most frequently mentioned in relation to program management is that here the strategic goals of the company have to be paid attention to. Hence, this is not the issue of one project, but of a number of projects; it is not only the matter of the project goals, but the company goals as well.

Program management allows for a number of different goals and results to be combined and is oriented towards the achievement of the program goals and the strategic goals of the company. The strategic goals of the company are a major issue. Defining the company's strategic goals allows for a selection of priorities, and it is on the basis of these that a decision can be made as to which projects will be included into the program, which is the order of execution, resource allocation and that a plan can be devised of the realization of individual projects and the program as a whole.

The development of project management as a specialized management discipline started from the Project Management dealing with managing one project, to Program Management which means managing a number of projects that

make up a program, to Project Portfolio Management which involves managing a number of independent projects and programmes. ICertan concepts of management through projects, multiproject management in the organization, etc. should also be mentioned here. (Jovanovic et al.,2010b).

The development of project management and devising new disciplines such as program management and portfolio management shifts the focus of attention from the goals of individual projects to the organizational goals. In case of program management and portfolio management, these disciplines concentrate on a number of projects in one organizationand thus clearly focusing upon the goals of the orhanization primarily and the extent to which individual projects within a program or a portfolio contribute to achieving the organizational goals.

A large number of big projects cannot be deemed successful if they are assessed from the point of view of classic project management and only in terms of time and the costs of the project realization. Although the time and costs of realization are often overrun, the implementation of project management in the execution of big projects is not disputable, however, here some other goals and outcomes important for the organization must be taken into account. This can especially be connected with the execution of a number of projects in the organization, when the classic project management concept cannot provide the desired outcomes, which was an impetus to develop project management further and define program management and project portfolio management.

The success in achieving organizational goals is not related to only one project, it rather depends on a set of interrelated or independent projects that each affect the goal achievement and overall organizational results in their own ways. In case of a number of interrelated or independent projects, attention should be paid to the goals and results important for the organization as a whole. In such a case, it is not possible to track and measure the success of individual projects; their overall impact upon the organizational performance should rather be taken into account. This means that a project portfolio and its impact upon the achievement of strategic goals and the overall performance of the organization should be perceived.

If project portfolio management includes the projects and programmes meant to achieve the strategic goals of the organization, then every organization also has certain projects that are not related to the strategic goals of the organization, however, should also be taken into consideration and carried out. Literature shows that there are disagreements as to whether all the programmes and projects in an organization are sections of one project portfolio or whether certain projects can exist outside the project portfolio (PMBOK Guide, Gareis,2005; Petrovic 2003).
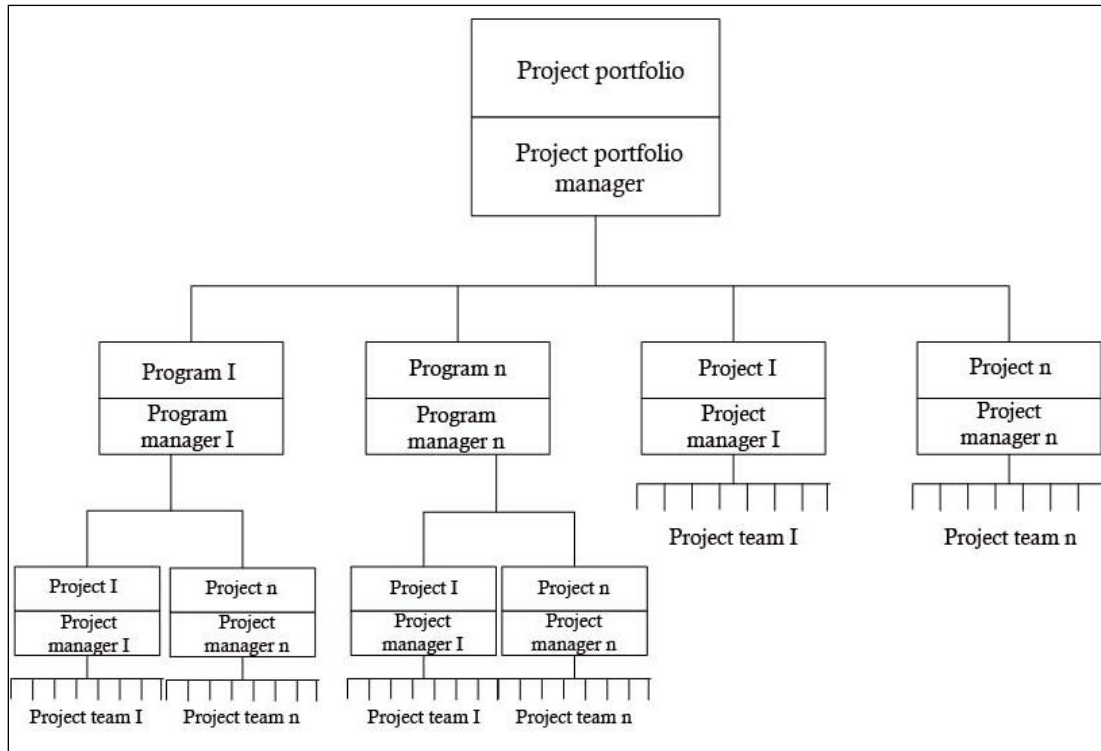
Figure 5.

The analysis of the path the organization can follow to achieve its goals in the future results into introducing strategy as a means to achieve the organizational strategic goals. The strategy implementation and the achievement of strategic goals is a major task of any organization and the only opportunity to achieve positive moments and future performance. Hence it is necessary that all the activities and projects arising from the organizational strategy should be realized efficiently employing modern disciplines such as project management, program management and project portfolio management. For a strategy to be implemented efficiently and for the organizational goals to be acheved, a new discipline, project portfolio management is implemented, which through a simultaneous execution of a number of projects and programmes that make up a portfolio, allows for the organizational goals to be achieved and thus brings strategic and project management together (Jovanovic et al.,2010b).

Project portfolio management has a clearly strategic component. It extends the time dimension of project management implementation and ensures a continual project cycle in conformity with a long-term horizon of strategic planning and management. Project portfolio management is based on a strategic plan and involves all the projects and programs that arise or are related to the organization's strategic plan. As the strategic plan has a continual dimension and since project portfolio management that accompanies the strategic plan also has a long-term and continual dimension, the projects and programs that support the strategic plan of the organization are realized in the course of project portfolio management; some are completed, some are abandoned or go out of the process and are included into another one, and continually so, due to the continuity of long-term planning. What is important is that the realization of certain projects help achieve the defined strategic goals of the organization. Since the strategic goals of the organization can also be changed and amended in time, this change can result into the changes and amendments of the projects and programs under way, i.e.,

abandoning some of the projects and introducing new ones (Levine, 2005)

The long-term strategic planning is the basis of project portfolio management, and, on the other hand, project portfolio management is an indispensable instrument in the realization of the strategic plans of the organization. Defining the strategic goals and the strategic plan of the organization means that individual projects and programs are defined in the strategic plan, whose realization means achieving the strategic plans of the organization. It also means that this process runs continually, in accordance with the continuity of strategic planning.

It is in this manner that the strategic component of the strategic plan and the operational component of project and program management are integrated, allowing for a required dynamics of the project and program execution and achievement of the strategic goals of the organization.

4. NEW APPROACHES – STRATEGIC PROJECT MANAGEMENT AND STRATEGIC PROJECT PORTFOLIO MANAGEMENT

The focus on the strategic perspective of the organization allowed for the development of new approaches in project management, such as strategic project management and strategic project portfolio management. The basis for the analysis of strategic project portfolio management are the fundamental premises and principles of strategic management and project management that should be taken into consideration when defining and discussing strategic project management (Jovanovic, 2009b). Strategic project management is defined as a new approach in the development of project management that introduces a need to manage the project in line with the defined organizational strategy and to complete the project in such a manner that it contributes to achieving both the goals of the project and the strategic goals of the organization. The results of the project are not oriented solely towards achieving the goals of the project itself; they have to aid the achievement of strategic goals and the business goals of the organization as a whole. Only in this way can the feasibility and efficiency of a certain project be assessed.

Strategic project management emerged as a need to coordinate a large number of different projects that were present in organizations and caused conflicting attitudes and problems in the use of resources and in achievement of the overall business goals and results. Strategic management allowed for organizations to analyse and think in a strategic manner and to set strategic goals and formulate respective strategies (Jovanovic, 2007). The implementation of certain strategies, however, was rather difficult to realize.

If a strategy were viewed as an individual project, its implementation was no problem, as the classic methods of project management were implemented. Since every organization, however, has a number of strategies, i.e., a number of projects and programe, the implementation of project management in a traditional manner failed to produce favourable results. For favourable business results in the organization to be achieved, it was necessary that strategic perspective and strategic manner of thinking in project management be introduced. This was achieved by strategic project management, a new discipline that is a specific combination of strategic management and project management.

Globally seen, strategic project management is concerned with project management with a strategic perspective of the organization in mind. When a number of projects and programs are to be realized within the implementaton of the organizational strategy, this is the issue of strategic project portfolio management. Very important here is the process of selection, prioritization and allocation of available resources to the selected projects and programs, in order that the company's strategic objectives should be achieved (Grundy & Brown, 2002).

Strategic project management can be described as a new project management concept that links the strategic aspects of an organization and the operational aspects of project management for the purpose of bringing the realization of a project into accord with the strategic objectives of the organization.

It is of great importance in the process of strategic project management that the business strategy be translated into the project strategy, i.e., that a link between the business strategy and the project strategy be created. The project strategy results from the link between strategic and project management and is a manner of translating business strategy into concrete projects and of defining the methods of their realization for the purpose of achieveing the company's goals and business results in an efficient manner. The translation of business strategy into project strategy involves a coherent set of processes that allow for an efficient realization of individual projects having in mind the company's strategy and strategic goals.

Project strategy entails a set of rules, principles and procedures on how to manage the execution of a certain project and achieve its own goals and the organizational goals as well. In order that organizational strategy be translated into project strategy in a most efficient manner, regardless of whether the project stands autonomous in the organization or is part of a program or a portfolio, it is neccesary that a coherent set of rules and processes that connect these two strategies be created.

Project strategy ensures a basic framework for the planning and execution of a certain project as well as for the achievement of the organizational and project goals. Basically, it describes the method of preparation, planning and conducting the project execution to achieve the project goals. The organizational strategy affects the project strategy creation and then the project execution and achieving the project goals. Project strategy, on the other hand, allows for a translation of certain important elements of the organizational strategic goals into the execution of a certain project. Hence project strategy is a transition phase from the organizational strategy to the project under execution.

A large number of business ideas and projects are proposed in every organization that in different ways contribute to achieving organizational strategic goals. The problem lies in the clear definition of the strategy and the strategic goals of the organization as well as in

a powerful link between the organization and the projects and programs selected. This means devising a precise definition of strategic goals and organizational strategy and a detailed explanation and and adoption by the top and a lower level management structure; however, it also means a valid selection of proposed project initiatives and deciding in favour of those that are interconnected and affect achieving of organizational goals essentially.

A clear and strong link between a selected set of projects and programs with the organizational strategy in order to achieve as good a performance as possible is the major task of strategic project portfolio management.

It is therefore necessary that a strong relationship between a clearly defined business strategy and correctly selected projects and programe be established and that this relationship be constantly checked and maintained during the project execution to achieve optimum performance in the realization of each project as well as optimum performance on the organizational level. It is here that strategic project portfolio management makes its entrance, a new approach in the development of project management meant to ensure the realization of previoisly stated intentions and tasks Kloppenborg et al.,2003)

Strategic project portfolio management is a new concept in the developement of project management that helps link the organizational strategy with the strategy of designing and realization of projects and programs that make up a project portfolio. The idea of this approach is to create a continual process of essential linking and permanent reconstruction of the project strategy and the project portfolio, which will in turn allow for the realization of projects and programs that will aid achieving the organizational strategic goals as well as overall performance in a best possible manner.

As regards the above mentioned ideas, strategic project portfolio management can be defined as a continual process of forming, managing the realization and reconsidering the project portfolio which is strongly linked with the creation and reconsiderations of the organizational strategy and oriented towards

achieving maximum performance of the entire organization (Moore, 2010).

5. BEYOND STRATEGIC ASPECT

In addition to the listed orientations and innovations in the development of project management it is necessary that four characteristics of the possible future development be mentioned, and they are clearly related to the realization and the anticipated outcomes of the project, although they are not discussed or taken into consideration in detail. These are:

- Project complexity

- Observation period (horizon)

- Broader perception of goals and benefits from the project

- Concern for the satisfaction of customers and other stakeholders

Project complexity means that projects are not only large themselves or containing a large number of subprojects or sections, but that there is a strong interaction between the sections and also with external factors. Hence managing complex projects is rather difficult and requires specific approaches and methodologies that are concerned with the effects of complexity upon the execution time and the project costs (Hertogh & Westerveld, 2009)

Although the traditional concept of project management is concerned only with the period of project preparation and realization, it is necessary, especially in large capital and infrastructure projects with a long-term exploitation period, that a project observation horizon be extended and the exploitation period be taken into consideration.

Taking into consideration the entire period of investment and exploitation allows for a more accurate analysis and assessment of the project validity and the overall achieved project results.

In case of large infrastructure projects (public, cultural, sports and other facilities, tunnels, bridges, etc.) the sole goal cannot be the project completion in the planned time period and within the planned costs and quality. It is necessary that the benefits in the exploitation period be taken into consideration and that project goals and project management goals be set in accordance to these (Jovanovic et al.,2010b).

In case of smaller-scale projects, attention is paid to the project goals (minimum time and costs) and to more or less short-term direct benefits. Important in large projects are both direct and indirect benefits, during the entire period of project exploitation. The exploitation period in these projects is really long, hence it may bring some indirect benefits that have not been predicted at the beginning of the project preparation or realization or could not even be predicted in that period at all.

The review of goal achievement and gaining benefits from the project deserves a detailed and rather accurate analysis and consideration. The review should start from the fact that the classic project management concept includes only the analysis of the project execution period (investment period) and that the general goal of managing a certain project is to complete it in the planned time and within the planned costs. In practice, certain, especially large, projects exceed the planned time and the planned costs, so they can be assessed as unsuccessful from the point of view of the traditional project management.

Such an assessment, however, may be poor and unjust as regards some goals and and benefits the project earns in the exploitation period. Therefore a broad review of project goals and benefits should include both the investment period and the exploitation period and offer the assessment of the overall success of the project. This, of course, does not exclude a partial analysis of the success in project management through planned goals and planned costs, which may be a request of the organization that hires a consultant to manage a certain project.

On the other hand, such an analysis necessarily introduces a question of who enjoys the benefits of the project as well as a special analysis of the project benefits from the point of view of the project beneficiary. In this case, the analysis of the goals and benfit achievement from the aspects of time and costs should be supplemented by the analysis from the

beneficiary's point of view. This means that it is necessary that a number of stakeholders should be taken into account in addition to the client the project is conducted for, and the society as a whole too, because they all enjoy certain benefits from the project.

The analysis and assessment of project goals and benefits achievement for all the abovementioned beneficiaries is performed by the Cost-benefit analysis which is well-known and largely implemented in investment projects of broader social concern (Jovanovic, 2010a).

In addition to the above analysis of new trends of project management, in the further development of different project management approaches and concepts, attention should be paid to customer satisfaction, that is, to the analysis of the clients' desires as to the project realization goals and the benafits they expect the project to bring. If individual clients, external stakeholders and the society in general are taken into consideration, their desires as regards the goals and benefits expected from the project can be expressed in the following way. In the project realization period (investment period), all the quoted stakeholdres can be interested in:

- Minimum time and minimum costs of the project
- Minimum time and planned costs
- Time and costs set and planned in advance

The interests in the exploitation period can be the following:

- Max profit from the project
- Max total benefit from the project
- Ensuring organizational development continuity
- Benefit for the society as a whole, etc. (Jovanovic, 2010a).

The synthesis of all the listed goals and benefits in both the investment period and the exploitation period should serve as basis for the analysis and assessment of validity of a certain project, program or project portfolio.

6. CONCLUSION

The development of project management as a specialist discipline is marked by several important characteristics, some of which are given below: a continuous broadening of the implementation area, introduction of new methods and techniques, the development of specific methodologies for specific types of projects, links with other management disciplines, such as strategic management and others, implementation of project management in managing organizations, etc. The development of project management in the recent years, however, is marked by devising new project management approaches or disciplines, such as: program management, project portfolio management, strategic project management, etc.

In addition, the future of project management as a specific managerial discipline will be marked by the introduction of new methods and techniques, regardless of whether they resulted from or are specifically related to project management or are "imported" from other scientific disciplines. New methods and techniques, new areas of implementation and new client requirements inevitably result in creating new concepts, procedures and methodologies of implementation. A specific role here will belong to innovations resulting from a growing and more direct relationship between project management and other disciplines such as strategic management, change management, risk management, knowledge management, etc. New methods and techniques and new concepts and methodologies, together with connections with specialized management disciplines, will allow for a broader implementation of project management in managing organizations, primarily in case of project oriented organizations.

The new strategic aspects of project management increasingly focus upon strategic goals and organizational strategies and link them with the execution of respective projects and programmes. It is for this reason that the position of project leaders ot project managers has to be strengthened. This means that the

project leader should be granted more authority in managing the project and program execution in order that he/she should be able to act efficiently in the new, considerably more complex circumstances.

In order that he/she should be able to perform these broader-range and strengthened roles and tasks efficiently, the project manager should master and develop some new skills and competencies, primarily those related to working with people. This means that the future project leaders will have to be subject to processes of permanent training and new knowledge acquisition and build their visionary, creative and communication skills, entrepreneurship and innovative skills in particular. The knowledge and skills of a permanent introduction of change and risk taking will be a sine qua non for the future project leaders.

Strategic aspects require new organizational models and approaches that insist on a flat or shallow organizational structures with fewer organizational and managerial levels which is already implemented in solving non-standard managerial problems. The virtual organization should also be mentioned, as it employs various virtual teams in managing dislocated projects and programs. Flattening the managerial hierarchy is necessary in certain types of specialised projects and this is achieved by reducing the number of managerial levels and granting broader authority to project managers and leaders in charge or by forming management teams in place of a powerful project manager or leader. Very interesting too are the ideas implemented in new, e.g. information science projects, about two project managers, which is one variety of the above mentioned management teams.

In addition to organizational goals, strategic aspects of project management stress a long-term perception on the period in which the project exploitation benefits are gained, as well as a broader circle of project users, i.e., the project beneficiaries in a long-term period of project exploitation, especially characteristic of capital projects. The project exploitation period, analysis of the project from the aspect of a broader circle of beneficiaries, and customer and other stakeholders satisfaction add to the range of possible goals and benefits and provide basis for the development of modern project management concepts.

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STANDARDS AND EXCELLENCE IN PROJECT MANAGREMENT – TWO SIDES OF THE SAME COIN?

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Abstract: This paper presents two different approaches to improving the project namely the standards for project management and the model for the project excellence. There is evidence that both standards in useful combination can dramatically increase the quality of projects.

Key words: Project Management Standards, Modell forProject Excellence, PM Excellence Award, IPMA

1. INTRODUCTION

The globalization in business relationships leads to customers having reached an unprecedented level of expectation concerning quality of products and services. Everything shall be offered as quickly and cheaply as never before. The international division of labour and the use of complex methods and techniques for the coordination of distributed work (IT systems included) are the prerogatives to achieve these goals. The quickly changing requirements of customers lead to an increasing amount of work being carried out in temporary organizations especially in international and national projects (Grau & Vossebein, 2010). The work in distributed and virtual teams is especially vulnerable to communication problems and misunderstandings. Therefore, it is very important to use standards as a common basis for joint project work, which is accepted by all collaborators. It is not surprising that such standards can only be the lowest common denominator.In addition, the strong bureaucracy is very often perceived as a negative element.
If so the use of standards is perceived as a restriction rather than help. On the other hand, the highest quality is expected. This means that the project team should deliver an excellent, outstanding project management. In every respect, they should meet the expectations of the customer or even better exceed them. Everybody expects an innovative, flexible approach and outstanding results.
What is the relationship between the call for standards on the one hand, and that for excellence on the other hand?

2. STANDARDS FOR PROJECT MANAGEMENT

If we accept the definition of the BSI (British Standards Institute) than a standard is "a published specification that establishes a common language, and contains a technical specification or other precise criteria and is designed to be used consistently, as a rule, a guideline, or a definition"(BSI). This definition sounds so plausible that one could easily get the idea that there is only one binding standard for the field of project management. However, we speak about standards for project management. This makes it clear that there is not a universal standard, but plenty of different standards (see fig. 1) (Grau & Grau, 2010).

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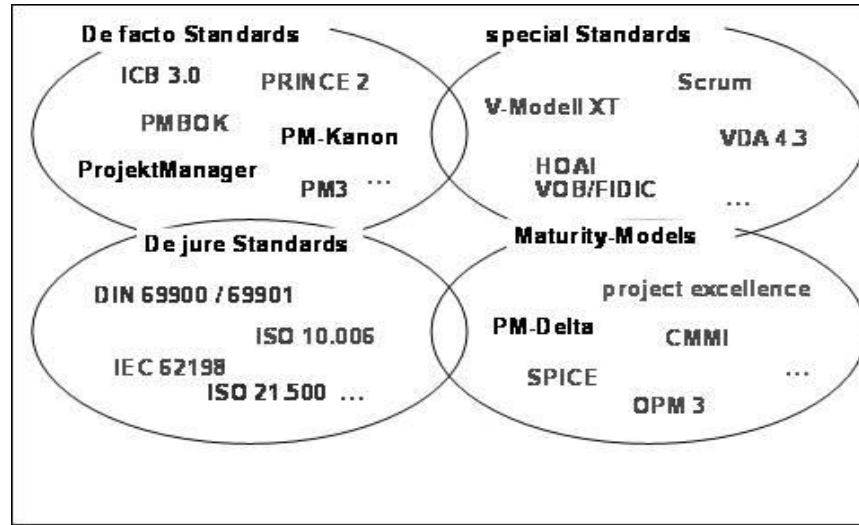
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Figure 1. Different Standards for Project Management

Different standards for project management (e.g. DIN 69.900 / 69.901 and ISO 21.500 under development) specify a lot, but allow the user to decide which of the recommended processes are useful for his or her project. The German Standard DIN 69 900 differentiates between processes, which are binding, and additional processes, which are recommended to be used (DIN 69 901-2).

On the one hand as many rules are set as necessary but on the other hand as much flexibility is granted as possible. By the participation of wide circles (e.g. users, industry, and academia) in the development of standards, a continued consensus solution is sought (Waschek, 2009).

3. MODELL OF PROJECT EXCELLENCE

The model for the assessment of excellence in projects (PEM - project excellence model) was developed at the end of the 20th century by the GPM (German Association for Project Management) (Otmann & Shelle, 2011). The model was used initially in the context of a selection procedure, for finding excellent projects and for paying tribute to their excellence in an award process. The fair assessment of the candidates was paramount. The model is so clear that it is used on the one hand for the assessors as a clear basis for their actions. On the other hand it is well comprehensible for the applicants (Grau & Hutterer, 1999). In addition, it was important to develop a procedure in a "train the trainer" process so that relatively quickly a large number of assessors could be prepared for their task. The model should be designed in a way that it could be accepted by many project managers without the need for extensive training. So the widespread model of EFQM (European Foundation for Quality Management) was chosen to become the model for PE.

This model was adapted to project management with relatively few changes. There were also many EFQM assessors available who could be trained by relatively little training to PEM assessors.

The model that was in use for several years in Germany was passed on to the IPMA at the World Congress in Berlin in 2002. From then on it has been used as a basis for assessment for the IPMA International Award.

From table 1, it is clearly visible that the model is applicable to projects of different scale.

It can be applied regardless of the industry or the type of project. It is therefore an open assessment model, which means that it can offer assessors plenty of freedom to use their own judgment.

Tab. 1: Different Categories of Projects applying for IPMA Award

Award Categorisation

Criteria	Project Excellence in Medium-Sized Projects	Project Excellence in Big-Sized Projects	Project Excellence in Mega-Sized Projects
Project duration	–	at least 1 year	at least 2 years
Phases completed	all finished	all finished	all finished
Project deployment (in months after project completion)	at least 3 months	at least 3 months	at least 6 months
Budget	–	at least 5'000'000 Euro	more than 100'000'000 Euro
Number of people involved in the project	–	at least 50	over 100
External sub-contractors and independent organisations involved	at least 1	at least 1	at least 3
Multicultural characteristics	is an advantage	is an advantage	is an advantage

The PEM-assessment model (see Figure 2) sees the possibility of maximum 1000 points awarded for the project. The nine criteria used for assessing are divided into two groups, with 500 points in each group. The two groups of criteria are the criteria for assessing the results of the project and the Project Management.
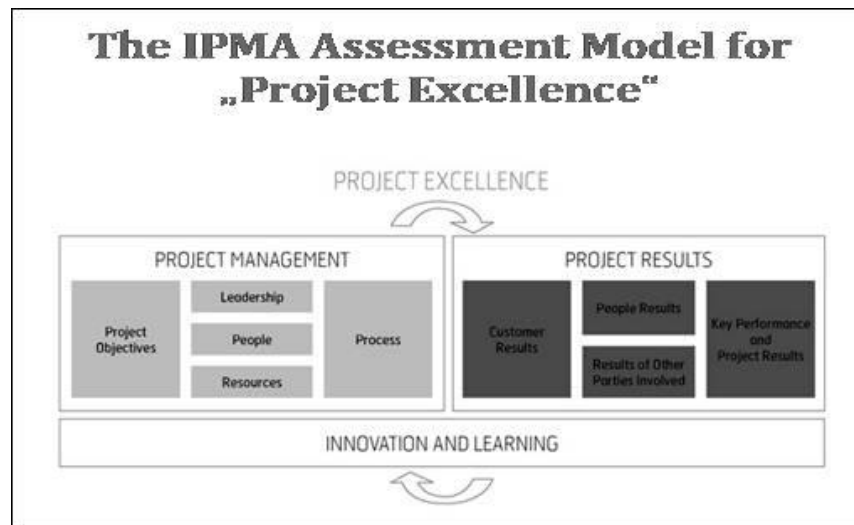
Figure 2. PEM – The IPMA Project Excellence Modell

Per criterion there is a different number of evaluation points (see Fig. 3). Each criterion is composed of several sub criteria which have to be evaluated individually. The partial results are then merged to a result per criterion. Because PEM is a very open valuation model, the evaluation process itself is of special importance.
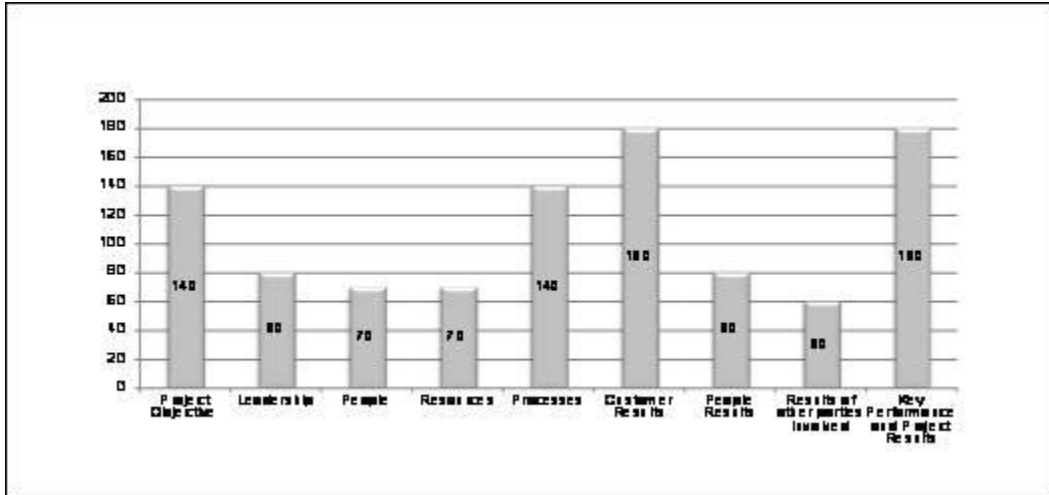
Figure 3. PEM – Points per criterion

In an elaborate process in the first step the assessors evaluate the application individually. Then all members of the respective team check their individual reviews in a consensus process. If necessary the result of a consensus meeting will be finally confirmed during a site visit with the project team (see figure 4).In this process, the knowledge and the experience of assessors are the second major precondition for the success of the review in addition to the model.
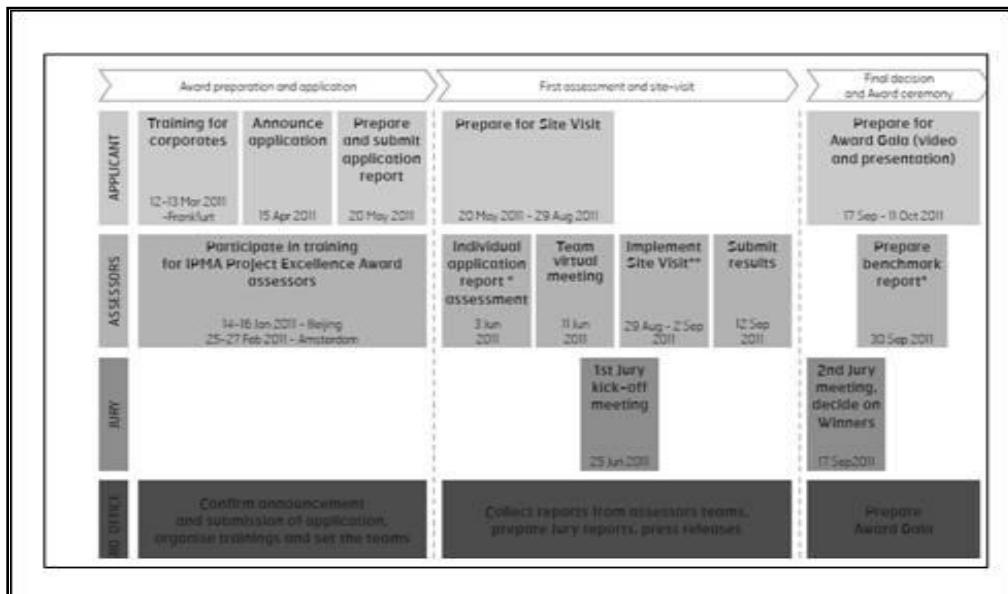
Figure 4. Process for the IPMA PE Award

There is a very similar situation when project managers use PEM for the internal use to improve project management in their own company. In addition to the ability to analyze entire as in the award process, there are other ways to benefit from the PEM. For example, one can:

1. learn from reports of Award or Prize Winners or Finalists about their projects and learn from their experiences in the sense of best practices.

2. identify smaller segments of a project and try to work in these areas excellently
3. last but not least you can apply for the award even if you do not hope to win the award. The bench mark report by the assessor team will already help one to improve one's own project

management with a relatively moderate effort for the participation in the award. Since both the model and the assessment procedure are publicly available, every project team can use it to improve their own projects.One can get an idea of the review of project management from the evaluation table for the criteria 1-5 (see table 2).

Tab. 2:Assessment table for the Quality of Project Management

A comparable table is also available for the criteria 6-9.Corresponding tables and notes for assessing are shown in the application brochure for the award of the IPMA. Although the model and the assessment procedure are publicly known, the success of the assessment depends on the knowledge of the assessors. This means that the model provides the maximum benefit, if the model and the assessment procedure can be combined, as provided in the IPMA award process assessment (see fig. 5). To do this one should provide usefully training to those who apply the model in the company. It is even better if all the assessors gained their experience within the framework of IPMA award process.
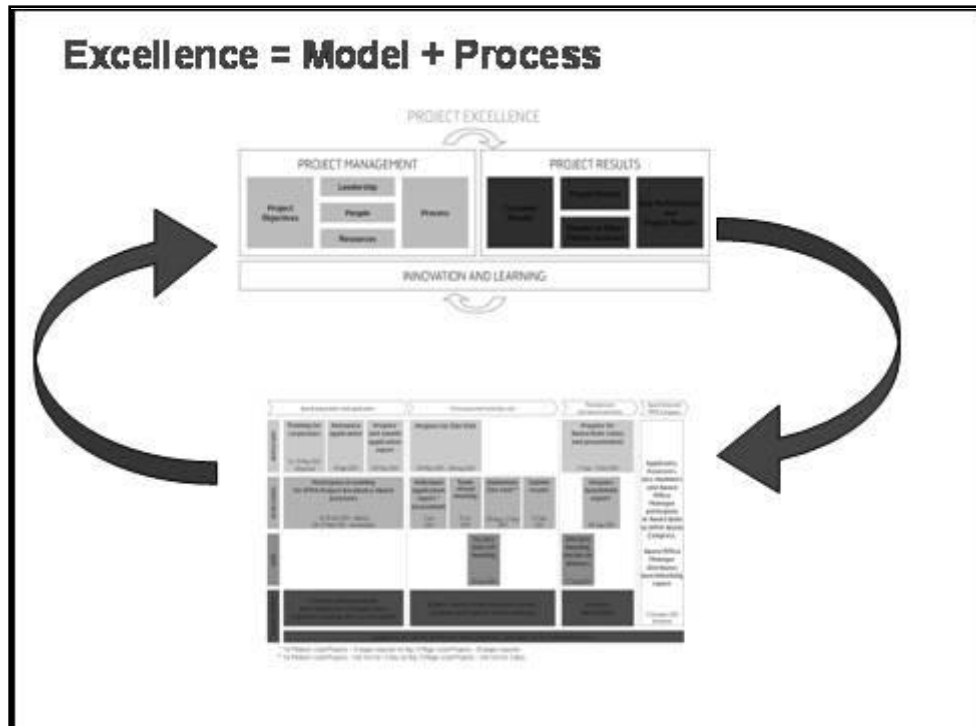
Figure 5. Combination of the processand the Model for PEM

4. CONCLUSION

The application of the model and the process for project excellence helps project teams to improve their projects and to make them excellent at least in the long run.This excellence can't be reached without taking into account the applicable standards for the basics. The standards are nowadays so flexible that they don't complicate project work unnecessarily through red tape and stifle the initiative of involved in the project. Useful project management will therefore apply the basic PM standards as the basis of their work to gain the freedom to achieve excellence in their project work through innovative and creative approaches (Grau, 2011).

Both areas help only in so far as they are able to be used by well trained, competent individuals involved in project work.

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PHASE MODEL OF PROJECT PORTFOLIO MANAGEMENT IN ORGANIZATIONS

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Abstract: The paper deals with project portfolio management in an attempt to define an adequate model to manage it. The project portfolio management model comprises three phases: project preparation for portfolio selection, the portfolio selection, and the post-selection phase. The implementation of this project portfolio management model is assumed to allow for an effective implementation of organizational strategy through the selection and execution of projects as efficiently and as effectively as possible. The model is associated with the role of the company's top management and the key decision-makers in creating an appropriate environment to achieve the set goals.
Key words: project, portfolio, management, project selection, prioritizing

1. INTRODUCTION

An effective project execution is today assumed to be the key factor of the company's business success. This is, however, only partially true. The competitive advantage does not result only from an efficient work on the project, but also from the selection of the right projects to be realized. The task of project portfolio management is to ensure an effective management of both the selection process and the project execution process.

Project portfolio management requires the implementation of adequate knowledge, skills, methods and techniques in a set of projects for the purpose of achieving or exceeding the requirements and anticipations of the company's investment strategy (Dye, & Pennypacker, 1999). This requires that a balance be established among strategic, tactic, and operations requirements. Project portfolio management often requires that it should be decided on what is possible and what is needed. Balancing between the possibilities and needs generally results in finding the best possible solution in the conditions of limited resources.

2. PROJECT PORTFOLIO MANAGEMENT

The project portfolio is viewed as a set of projects an organization conducts in a given time period. It includes research and development projects, work process improvement projects, IT projects, cost reduction projects, product and service improvement projects, projects for purchasers, etc.

Portfolio management is of critical importance for the effectiveness of project-oriented organizations in particular. It covers the areas such as project selection, project prioritization, resource allocation and the implementation of the company's business strategy. Portfolio management should provide answers to the following questions (Cooper, Edgett, & Kleinschmidt, 1998):

- Which projects should be realized?

- Which is the most efficient method of organizing projects in order to achieve the desired goals?

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- Which is the right relationship between projects?

- Which project mix can provide best results?

- Which projects are of highest priority?

- How should resources be allocated among various projects?

The process of creating a project portfolio is necessary in order that the right projects should be realized. The first step the organization has to do is to identify the capacities, then assess organizational adjustment, analyse costs, benefits and risks, and finally design and select the project portfolio. Every organization has to undergo this process to be able to make an appropriate project mix. The methods and techniques to be used may differ in terms of organizational maturity, the project types, and experience in the project mix making. Project portfolio management is an important factor of a long-term strategic success, especially in case of project-oriented organizations.

Project portfolio management is responsible for a consistent approach to classificatin, selection, prioritization and planning real projects and programmes in the organization. The goals of project portfolio management are the following:

- optimization of project portfolio outcomes (not of an individual project or programme);

- adjusting projects and programmes to the organizational strategy;

- selection of projects and programmes to be realized;

- defining project and programme priorities;

- halting or abandoning a project or programme;

- coordination of internal and external resources for projects and programmes; and

- organizational learning between projects and programmes.

Project portfolio management has to ensure an effective organizational strategy implementation through the realization of respective projects in as effective and as efficient ways as possible (Cleland, 1999). It is associated with the role of the top management of the organization and the key decision makers in creating an appropriate environment to achieve the set goals.

The focus in project portfolio management is upon a clear definition of the values the projects have for the organization (Bridges, 1999). Project portfolio management is implemented in all the projects, making decisions on the selection and prioritization that are adjusted to the organizational strategic goals and development.

In addition to decision making on the realization of projects in the project portfolio, the organizations go through another process of final approval of the very beginnings of the project execution as well as of individual phases of project execution. Obviously, there should be a lower level of decision making that goes on in the real time of the project execution. Decisions within the portfolio are made in certain time intervals and all the projects are discussed jointly, whereas the decisions concerning individual projects and any transition of the project from one phase of execution into another are made on a lower level. All the abovementioned may result into conflicts between these two levels of decision making in the organization, the more because decision-making processes most frequently include different people and even different criteria.

Despite the fact that it takes into account all the projects together and compares them, decision making at the portfolio level does not pay due attention to individual projects. On the other hand, the lower level focuses upon only one project, not inluding into consideration other projects. It is very important for the organization that these two processes be integrated and harmonized. The dominance of one of the two processes is undesirable in any organization.

The research conducted by Cooper, Edgett and Kleinschmidt (1997) found that the major problems the organizations encounter in the project selection and portfolio management are the following:

- Project portfolio does not reflect the organizational strategy;

- Portfolio quality is low;

- Inefficient procedures of control and decision making at the point of testing;

- Scarce resources and lack of focus;

- Simplification of product developmet projects.

The issue that the organizations implementing the concept of project portfolio management have to resolve is whether the projects that are under way shoud be abandoned or deprioritized in favour of better projects that appear? On one hand, the resources employed in the projects should be flexible and able to be transferred from one project to another, as need be. The reason for such an attitude lies in the need that the management of the organization should have the opportunity to allocate resources in an optimal manner, regardless of their current engagement. On the other hand, there are opinions that the resources engaged within the project team have to remain on the project throughout its execution, regardless of whether a more attractive project is in sight. Here, the issue of continuity and the ethics of the project team is much more important in comparison with the optimal resource allocation. Such an attitude results from the reasoning that abandoning and then starting a project anew means a large-scale loss of both the resources and the time, that transfer from one project to another may have its consequences and that launching and stopping or a final abandoning of the project requires additional time and new costs.

New projects always appear more attractive than the ones in progress, hence the resources from the projects that are in finishing phases are generally transferred as support to new projects. Such a decision may sometimes result in the projects from which the resources have been withdrawn never being completed (Meredith, & Mantel, 1995). A far-reaching consequences and damage for the company are usually overlooked at that moment.

There is no universal rule as to what should be done or which policy of work should be set in the organization in this context. What is certain is that long-term projects require continual work to obtain adequate outcomes. On the other hand, there is a need to devise a flexible model of resource allocation, in accordance with the changes on the market, in technology or the opportunities offered.

The strategic implications of portfolio selection are complex and diverse. They include the analysis of internal and external factors in the company, its market position, strengths and weaknesses of the organization. Such analyses may be used to devise a broad prospect of strategic orientations as well as specific initiatives for competence advantage. This procedure can be used in developing focused goals of the project portfolio and defining the resources required to support it. The assessment of the strategic position of the organization uses the project portfolio matrix where the different criteria for organizational positioning are presented in one or more graphs within the two described dimensions. Such a presentation can be used by the decision makers in assessing the current position as well as the position they wish the organization to be in the future. Clearly, the strategic orientation of the organization has to be defined prior to the analysis of individual projects meant for the project portfolio. Successful organizations conduct a large-scale strategy preparation and planning prior to analysisng individual projects.

Once the the strategic orientation has been determined, it is necessary that projects be selected and resources be allocated. The project selection includes the identification of opportunities, the assessment of organizational adjustment, the cost analysis, the risk and cost analysis, the portfolio forming and the portfolio selection. The success of an individual portfolio depends on the competence and support of the organizational management. This is much more important, sometimes even crucial, in

comparison to the selection of the method to be used in the project selection.

A periodical review of the project portfolio is certainly necessary. This means that all the active projects as well as those on the waiting list should be reviewed and compared with one another. The aim of this review is to ascertain if there is a true set of active projects and whether these are the projects compliant to the strategic goals of the organization.

In order to aid the decision-making process, it is necessary that general criteria are established and assessment of each active project is performed as regards these criteria. As a majority of decisions is based on manyfold factors, each criterion has to be valuated to establish a relative importance of each of them. This would help identify what is most important for any organization, and each project would be measured in relation to the criteria significant for it.

The organization has to establish an unbiased project monitoring and control mechanism. Measuring can be based on the project revenue as regards the assets invested, on measuring the mutual performance of a number of projects within the project portfolio, or on measuring the continuity of project adjustment to the overall organizational goals. It is important that there be an agreement on the priotity defining process, agreed upon in advance. Only when the organization defines its overall objectives and the project investment strategy, can it create an optimal group of projects to implement its strategy and achieve the set goals.

For the adequate ratio to be achieved between the risk and the revenue rate from investment into the project it is necessary that every project be assessed from the point of view of its two characteristics: technical complexity and added value. The secret of a successful project management is in understanding critical relationships between the probability of success and the value the project will earn if successful. This provides a solid basis for quality decision making on the input project portfolio.

A majority of portfolio decisions is aggravated by a long time period, high uncertainty and a large number of variables affecting each project. The most commonly used tools in the development of the business model that would in turn anticipate the potential project value are impact diagram, sensitivity analysis or decision making tree.

The goal of the decisions related to the project folio decisions is not only the selection of the right projects; it includes strengthening the right people and their groups to enforce the decisions made in an efficient and effective way. The creation of an appropriate level of participation between cross-functional teams ensures a constructive dialogue between decision makers and those who realize these decisions, which in turn results into agreement on the final actions to be conducted.

The portfolio analyses and deals with the future events and opportunities where the majority of information necessary in the project selection is uncertain at their best, and largely unreliable, at their worst. The decision making environment is dynamic, and the status and prospects of the project in a portfolio constantly changes with the inflow of new information and new technologies. The projects in the portfolio are in different phases of execution and they compete for available resources. The resources to be allocated among projects are limited, hence a decision to allocate resources to one project means withdrawing these resources from another project, and this transfer of resources from one project to another has its price.

3. PROJECT PORTFOLIO MANAGEMENT MODELS

According to the research conducted by Cooper, Edgett and Kleinschmidt (1997), the papers dealing with the project portfolio management issues first appeared in 1970. They analysed the issues such as "selection of research and development projects", "resource allocation in research and development projects", "project prioritization", and "portfolio management".

The majority of early works in this area deal with the portfolio management problem in that they define the optimization methods and techniques. According to these works, the

portfolio management problem means a limited optimization in the conditions of uncertainty: the multiproject and the multilevel decision-making problems should be resolved employing mathematical programming. The initial models in selecting a project were mathematics-oriented and used the techniques such as linear, dynamic and integer programming. The aim was to develop a portfolio of new and of existing projects to maximize certain function goals (e.g., anticipated profits) as an issue of establishing resource constraints.

The implementation of these methods immediatley revealed the difficulties arising in solving the project portfolio management problems. Regardless of the numerous methods developed in this early stage of approach to this problem, none of them has found an adequate implementation in project portfolio management.

Practice knows of two general methods or two schools of thought prevailing in the system of portfolio decision making. One is based on defining certain strategic groups and their subgroups, as well as on defining a certain sum of financial means allocated for such projects. It is in this manner that the projects that have a certain purpose and a quality of input information are classed into respective groups. The selection of projects is conducted within a group or a subgroup since in this way they can

be compared more easily.

The other approach is based on the rule that all the projects competing for the same resources should be compared one with another, without being classed into separate groups or subgroups and allocating resources among such groups. This means that if the projects on the reduction of labour costs are by far better compared to the projects on new product development, the financial resources should be allocated to the former. In this way an artificial and *a priori* allocation of resources to projects that are of poorer quality in comparison with other available projects is prevented.

Today there is a gap between a majority of management models and the environment in which the projects are executed. These models were created in the conditions in which the consequences of certain decisions and the impact of project upon the organization and the social community in general could be predicted. In today's project environment, a successful project portfolio has a lot of non-economic characteristics, iterative budget process is used and what seems to be the best decision for the organization need not be perceived as the best decision for all the stakeholders. Today's project environment is more complex than many a management model, and such complexity has to be taken into account in any process of defining the "best" project portfolio to be executed.

The weakness of portfolio models is also associated with the accuracy or relevance of the data on the basis of which the processing, analysis, concluding processes are carried out and finally a relevant decision is made. The models used in portfolio decision-making are by far more advanced in comparison with the input data. The financial indicators, the criteria and the data processing and presentation method itself can be excellently thought out and functioning towards the final decision.

All the calculations and use of adequate criteria, however, may result in wrong conclusions if the data used are incorrect, inaccurate, or unreliable. If the intention is to improve the performance of the portfolio decision-making process, a higher level of input data quality has to be ensured.

Many organizations have found the implementation of solely financial methods and criteria for the purpose of project prioritizing to be inadequate. The reasons most frequently lie in financial simplification which makes the project picture unreliable, especially prior to launching the project when prioritizing is most necessary, however, also during the project execution. The analyses conducted upon completion of the project reveal that the valuations of key parametres on the basis of which decisions were made were significantly incorrect.

Although there is a large number of project valuation and portfolio selection techniques, there is, on the other hand, a complete lack of

the model for an organized implementation of logical and flexible processes meant to reduce or surpass these problems.

4. PHASE MODEL IN PROJECT PORTFOLIO MANAGEMENT

Organizations may have the best ideas and methods, however, if the portfolio management process is not structured or implemented correctly, there will be problems in the project selection and implementation. An effective project portfolio management needs an a priori defined necessary processes, and the implementation plan should be agreed on prior to launching new projects.

Organizations need to work on devising a model to help them manage the project portfolio. One possible approach to project portfolio management is a phase model presented in Figure 1.

The proposed model of project portfolio management decomposes the process into a series of individual phases that flow from the initial strategic analysis to the project completion. The components presented against grey coloured planes represent the activities preceding the portfolio selection process. The rectangular forms with discontinuous lines present the data generating elements that are further filled in as the portfolio is created and may affect the portfolio management in some future time.

The purpose of the proposed model is to define and organize the project portfolio management process. The model is not associated to any method or technique generally implemented in decision making; this is in the domain of the model user, the project type, the decison maker's preferences. Certain proposed phases can be changed, replaced or completely removed if the organization decides in favour of a different approach to this process. Certainly, after the model has been implemented for the first time, a review should be made of both the strategy and the selected methods and techniques.
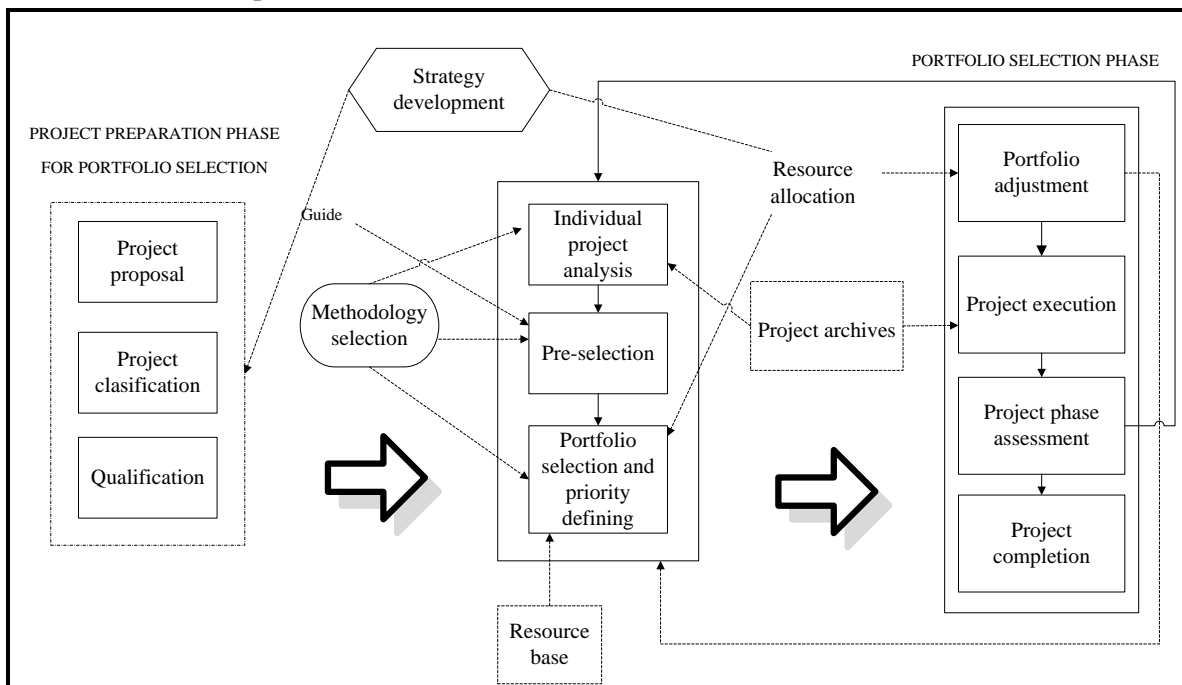

Figure 1. Phase model in project portfolio management (Petrović, 2003)

The project portfolio management model consists of three phases:

- phase of project preparation for portfolio selection,

- portfolio selection phase,

- post-selection process phase.

The first phase is to aid the project classification and qualification, the second phase is the phase of project selection, of defining the strategic focus and of budget allocation. Adjustment of the portfolio as to the project paremetres of candidate-projects, including their interaction with other projects through resource restratints or other interdependances is performed in the third phase.

Background

Defining the elements that precede the project portfolio management process is intended to aid a correct flow of management. The activities preceding the portfolio selection process are presented in grey-painted planes in Figure 1. These include "Strategy development" (defining the strategic focus and setting resource constraints) and "Methodology selection" (defining of the procedure and the selection of methods and the techniques to be implemented in the portfolio selection).

Defining the strategic focus should be conducted on a higher management level. Resource allocation to different project categories also includes a higher level of decision-making that has to be completed prior to the portfolio selection process. The selection of methodology should be based both on its comprehensibility for those who are to implement it, their willingness to learn or adopt a certain approach and on the prior experience.

The selection of methods and techniques for a particular class of projects, the problem solving style and the final slection of methodology generally depend on the organizational culture of the company. Certain activities within portfolio management require that a number of methods and techniques be combined. A simple check list containing the criteria to be met can be used at the beginning of the project;

considerably more sophisticated methods will be implemented in the projects that are already in the process of execution. On the other hand, the criteria used to test the project in the course of its execution have to be consistent with the criteria used in the first assessment of the project, so that an adequate comparison between the projects can be possible.

Project proposal and project classification

The project proposal should have an a priori defined form on the organizational level. This will ensure that the further flow should go without requirements for additional data. The project proposal includes the business goals, the project goals, the deadlines, the budget, the constraints and the assumptions that affect the project. The project proposal can be in the form of the pre-feasibility study, a feasibility study or a business plan.

All the proposed projects have to be classified in accordance with the project type. The project classification criteria are defined on the organizational level and in compliance with the company management system and business operations. Projects are classified as internal and external, according to the required financial funds and their sources, their technical structure, their importance for the company, their purpose, etc.

Qualifications

This step helps eliminate the projects that are not feasible before the portfolio selection phase starts, and is based on the general information on the project. Qualification makes it possible to reduce the number of project to be analysed in the selection process. The qualification testing of the project may be administrative, based on specific guidelines.

Qualification precedes the concrete portfolio calculations. Already prepared instructions or guidelines devised in the strategy development phase can be used, where each project has to be analysed from the point of view of project complying to the strategic focus of the company. Identified here are the projects that are compulsory and that will also be included into the rest of the portfolio selection process. Compulsory projects are those for which an

agreement has been reached that they have to be carried out and without which the company cannot operate in an adequate manner.

Individual project assessment

In this activity, the input data for individual projects are analysed and processed in the form appropriate for further analysis. Here the general set of parametres necessary in the following phase is calculated for each project, and is based on the values estimated in the feasibility study and/or databases of the previously completed projects. The projects already under way that have reached certain key events may be assessed again in this activity. The assessment of such projects will include less uncertainty in relation to the newly-proposed projects that are not launched yet. The output of this phase is a general set of parametres calculated for each individual project. The data may also be qualitative, and most frequently encountered quantitative data on the project are the anticipated net present value, risk and the resources required over a time period, including the uncertainty estimate of these parametres.

Pre-selection

The number of projects proposed for the portfolio may be rather large, and the complexity of the decision-making process and the time required that a portfolio should be selected increases geometrically with the number of projects under consideration. Project selection can also be a trade-off if a large number of projects is analysed unnecessarily. It is for this reason that a pre-selection process should be implemented, in order that the projects that are not in the company's strategic focus be eliminated. For example, pre-selection can be used to eliminate the projects that do not bear sufficient information on the basis of which a logical decision can be based, those that do not meet the requirements such as a minimal internal profitability rate, etc.

In the course of this activity, the calculations from the previous step are used to eliminate projects that do not meet a defined indicator treshold such as, e.g., the return on investment rate. Testing the project against indicators can depend on certain guidelines that may eliminate all the projects that are not compulsory to realize, and whose internal profitability rate is lower than a set amount. The intention is to eliminate all unsuitable projects and reduce the number of projects to be analysed simultaneously in the portfolio selection activity. This does not apply to the projects that are compulsory or necessary as support for other projects. Attention should be focused upon preventing the elimination treshold to be set, since it is ungrounded, and thus eliminates otherwise potentially rather promising projects.

Portfolio selection and prioritizing

This activity combines the outputs from the previous steps in a manner required for a portfolio selection based on organizational goals. This can include an extensive interaction with the company's management and a comparison of prospective projects with numerous goals, or it can involve smal-scale direct interventions if optimization techniques such as 0-1 integer programming are implemented. The output of this step may be the preliminary ranked projects based on the portfolio-specified goals and the initial resource allocation in accordance with the quantities available. This step is the first step of problem solving, to be continued in the post-selection phase where a final adjustment is achieved by the decision makers and also new calcualtions are done as necessary to provide support to the portfolio analysis.

The interaction among different projects should also be analysed within this activity, including interdependence, competition for resources, execution time, all on the basis of the calculated values of each project within the general set of parametres from the previous steps. The AHP, the scoring model, and portfolio matrices are popular with the decision makers on portfolio selection, as they allow the users to view a broad range of quantitative and qualitative characteristics, as well as achieving manyfold goals. None of the above listed techniques, however, analyses manifold resource restraints and project interdependence. The AHP, pair comparison technique, Q-sort are also too cumbersome and inadequate to be implemented on a large number of projects.

Within this activity of the phase model of project portfolio management two steps for portfolio selection are proposed. In the first step, a relative total benefit for each project can be determined. A comparative approach such as Q-sort, pair comparison technique and the AHP can be implemented in this step for a smaller number of steps, allowing for the analysis of both qualitative and quantitative indicators. This step may require more work from the Project Portfolio Board members for the purpose of comparing prospective project pairs. In case of a larger number of projects, the scoring model is more appropriate as it does not involve the comparison of a large number of project pairs. The result of this approach should be the establishment of a relative value of each project.

In the second step, all the project connections, resource availability and other constraints should be involved in the total portfolio optimization based on a relative value of each proposed project. If all project measures can be expressed qualitatively, the first step can be omitted since the optimization can be carried out directly by a mathematical calculation in the second step. In specific cases, where the interdependence and time constraints are not important and where there is only one resource important in allocation, the second step can be simple in that only the highest-value-bearing projects will be selected until the available resource has been used up. This, however, does not mean that an optimum portfolio will be selected since a combination of given projects can produce a more substantial total benefit than a set of projects with highest individual utility each. The realtive value of each project can be an input into a software-supported process, that can be based on the 0-1 integer programming, and that uses the resources, the time, the interdependences and other constraints to maximize the total benefit. Goal programming can also be used for manifold goals in this step in case more than one goal is explicitly identified.

Portfolio adjustment

This is the activity in which the decision makers perform the final adjustment of the project portfolio. Presentations of one or more portfolio matrices are used as support and the critical variables required for decision-making and selected by the Project Portfolio Board for this purpose are critically reviewed. All the connectivity among the projects, such as interdependence and interexclusion are already taken into account in the previous steps and can be presented, if necessary, during the adjustment process. Portfolio adjustment is a reasoning problem that requires a feedback from the Project Portfolio Adjustment Board because of the consequences of the decisions made. The data for this activity are provided by the sensitivity analysis using the same model applied in the portfolio selection analysis.

The end result of adjustment should be a portfolio that meets the organizational goals to an optimal or nearly optimal extent, however, with a possibility for final adjustment left to the Project Portfolio Board. The project portfolio selection is a strategic decision and certain information has to be presented to enable the decision maker to assess the portfolio without being burdened by too many data. The final step is the portfolio adjustment which provides a complete insight, where the project characteristics of critical importance in an optimized portfolio (e.g. net present value, completion deadline, etc.) can be presented using a matrix presentation, together with the impacts of each proposed change in resources or projects selected. It is very important that only a limited number of these presentations (schemes) be included in order that confusion should be prevented in making the final decision. If needed, it is possible to make some changes in the projects. If changes essentially differ from the portfolio developed in the previous activity, it is necessary that the process is reversed in order to re-calculate the portfolio parametres. It is also necessary that a sensitivity analysis be conducted in order that the impact of changes (project adding or excluding) upon the resources and the portfolio optimum should be predicted.

An important aspect of portfolio adjustment is achieving a form of balance among the selected projects. For example, not many highly risky projects should be proposed due to the fact that

the failure of a number of such projects may endanger the future of the organization. On the other hand, low-risk projects may not earn a high return on investment, which is in turn often typical of risky projects, thus the anticipated returns from portfolio may be too low if the project selection is too conservative when it comes to risk. The balance in view of the size of the project is also important since engaging a large portion of resources in a couple of large projects may be fatal if more than one projects fail. A large number of long-term projects, however promising they are, may cause financial problems related to cash flow.

Project assessment in the execution phase

A perodical review of the project is part of portfolio management. It means a review of all the active projects as well as the projects currently on the waiting list and comparing one with another. The aim of such a review is to establish whether they make the right set of active projects and whether these projects comply to the strategic goals of the organization.

5. CONCLUSION

The aim of project portfolio management is to allow for a consistent approach to classification, selection, prioritization, planning and realization of the right projects and programmes in the organization. Project portfolio defining and management allows for an effective implementation of multiproject management.

Project portfolio management is characterised by uncertainty and changing information, dynamic opportunities, manifold goals, strategic analyses, interdependences among projects, manyfold decision-making and group decision-making. Portfolio defining and management is today one of the most demanding processes in modern business operations.

Despite a large number of approaches that can be implemented in portfolio selection, there is still no consensus on which is the most effective one.

Consequently, every organization tends to decide upon, for the project class under

analysis, the approach that fits the existing organizational culture and allows for the analysis of project attributes it deems essential.

Similarly, the approaches that are most useful for the portfolio development in one project class may not be the best solution for another (e.g., good assessment of quantitative values such as costs and time are adequate for certain construction projects, however, qualitative assessment is more likely to be used in new product development projects).

The development of an efficient project portfolio management approach is not an easy task. There is no one single adequate approach to the portfolio that can be implemented to any orgenization. Certain research (Cooper, Edgett, & Kleinschmidt, 1998) have revealed that the most efficient organizations, in view of the portfolio performances, really approach to many elements in a much more different manner compared to the organizations with poorer performances.

A general conclusion can be drawn that there is no approach to project portfolio management that could hold monopoly in implementation or in its characteristics.

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OPEN LEARNING COLLABORATION PLATFORMS FOR LARGE INFRASTRUCTURE PROJECTS – NETLIPSE CASE STUDY

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Abstract: Technological and organizational excellence is the key element for business success in any modern business and project environment. Post globalization and instable business environments demand permanent improvements and changes of business processes. "Open the boxes" and exchange information, ideas and set-up collaboration with stakeholders such as customers, end-users, clients, vendors, business partners, potential competitors – this is a challenge of current (project-) organizations and their innovative environments. The open innovation environment concept was born in 2003, presented by professor Chesbrough from Berkley. Since then, researchers and practitioners are searching for successful applications of this idea. How we can improve the performance of large infrastructure projects by using this concept of work will be presented in this paper. The theoretical introduction will be illustrated by practical example of the existing NETLIPSE knowledge network. NETLIPSE is the network for dissemination of knowledge on the management and organization of large infrastructure projects in Europe.

Key words: Network organization, open innovation environment, innovative business models, large infrastructure projects, project management

1. ORGANIZATIONAL EXCELLENCE AND NEW BUSINESS MODELS

Globalization of businesses and fast development of ever more useful and user-friendly, modern information and telecommunications technology enables creation of business integration and participation of partners from different parts of the world. Emerging new innovative business models better serve customers and business partners' satisfaction needs. They alter the economic order; we witnessed a large global cultural change. National borders will become increasingly less obstacle in business and other organizations.

We see that the competencies required for a fair global business environment are very different from those typical of the industrial era in the 20th century. Unfortunately, they are still encountered in practice in most companies and project organizations today. The product value creation process was driven by suppliers in the industrial age. Significant for the industrial culture was the absence of customers' inclusion in product development processes. The most important issue for this phase is ability to produce quality and competitive products. Many modern organizations are in the development phase of the transaction culture. The main characteristic of this phase is creation of wealth by business transactions.

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Organizational excellence is one of the main drivers in this stage which has been present in last twenty years. The business excellence is in search of organizational excellence, where extrinsic organizational rewards are often still more important than real intrinsic personal satisfaction of all organization's stakeholders. Nowadays when we are entering the knowledge based economy, real intrinsic personal satisfaction becomes one of critical success factors of global competitiveness. Inclusion, collaboration, co-creation, customer satisfaction and "win-win" approaches are the main characteristics of this phase and organizational culture. The key factors in this development stage are the people involved. Competent and highly motivated people (internal and external) can provide results which reach beyond owners, managers or client expectations. This can be reached by utilization of personal excellence and satisfaction of all involved parties.

In this post globalized world, organizations are facing constant competition from both regional and the global markets; demanding to increase their pace to innovate, produce and provide at higher quality with a higher degree of customizability of their products and services. In order to secure sustainable competitiveness, the leading organizations have recognised the need to shift from classic organizational structures to being more diverse and distributed internally as well as externally, mainly depending on collaboration as a basis for competitive advantage in innovation (Mertins, 2003; Firestone, 2002).

For organizations, this change is driven by directed and sustainable collaboration with their complementing entities holding relevant knowledge.

This concept of work is supported by the idea of an open innovation environment (Chesbrough, 2003) which says that nowadays organizations needs to collaborate with their business partners and all other relevant stakeholders, to secure permanent inflow of new information, ideas and proposals to support the internal innovation processes.

For this reason supporting the right position of knowledge, information sources and their interaction to optimize the collective view of all the stakeholders is of key importance. The bigger impact of such a structure could be foreseen in the virtual associations that are mostly objective and are based on knowledge resources (Byrne, 1993; Pettigrew, 2003). Thus far these professional associations are mostly conceptualized in theory as knowledge workspaces that are established based on similar knowledge focuses, facilitating from professional clusters to expert groups. In practice the virtual professional platforms have proven short-lived and one of the main reasons identified is the lack of sustainable and scalable governance mechanisms.

That fact changes and produces new forms of economic and non-economic activities, whose main features are increasing responsiveness to customer requirements - users, increasing responsiveness and flexibility of business units, increasing labor flexibility, the ability to quickly respond to changes in global markets, capacity building and project team working. It is a process of changing values, which are crystallized into the formation of a new organizational post globalized culture. Values that will increasingly be, are associated with improving the level of responsiveness to customer requirements-user on the global market changes, the degree of innovation, the rise in the inter-organizational collaboration culture and interpersonal cooperation, co-creation and creativity.

Described new concepts of work we will illustrate by the practical example of the European NETLIPSE program. The NETLIPSE program focuses on increasing and dissemination knowledge on the management and organization of large infrastructure projects (LIPs) in Europe. These projects include high speed railway lines, highways, waterways and tunnels. The main goal of this program is to create and develop an open innovation environment, where main LIPs stakeholders such as client organizations (ministries, local governments), infrastructure research and knowledge institutes and projects themselves, from different European countries can exchange their knowledge, best practices and collaboratively search for the best models and

improvements of existing business designs in order to improve the level of project management at this level. The NETLIPSE program was co-financed by the EU FP6-FP7 fund from 2006 – 2008, and is now funded as part of the TEN-T Executive Agency Annual Program.

2. NETLIPSE KNOWLEDGE NETWORK COLLABORATION PLATFORM – CASE STUDY

2.1. A European Transport Network

An efficiently delivered and operated European transport network is essential if the European Union is to ensure their economic and sustainable competitiveness. The TEN-T is the European Union's Transport Infrastructure Framework. Initially adopted in 1990, it now includes Priority Projects on 30 international axes plus wider transport projects.

These projects are targeted to improve the economic efficiency of the European transport system and provide direct benefits to the European citizens. The priority projects, mostly rail and inland waterway schemes, will help contribute to creating a more sustainable transport system and help fight against climate change. In May 2008, Vice-President of the European Commission, Mr. Jacques Barrot, presented the first progress report to the Informal Transport Council on the implementation of the TEN-T priority projects. In it, he praises the Member States and Community Institutions in their efforts to accelerate the delivery of the priority projects.

Project delivery and effective realisation being a challenge of the past programming period, Barrot also promised to step up efforts in encouraging Member States to not only coordinate their transport policies by exchanging best practices, but also by identifying early obstacles to funding and solving cross border constraints.

2.2. The NETLIPSE Program

From 2006-2008 the NETLIPSE project, a project in the Sixth Framework Programme, focussed on gathering best practices and lessons learnt in the management and organisation of large infrastructure projects (LIPs) in Europe. 15 LIPs were researched by regional knowledge teams, consisting of experts in the field of project management (representatives from the scientific, project management and client organisations). The NETLIPSE (NETwork for the dissemination of knowledge on the management and organisation of LIPs in Europe, www.netlipse.eu) project presented main findings and an overall vision of how to manage, evaluate, monitor and benchmark LIPs in April 2008. In addition to carrying out the research, the project consisted of setting up an active network for the continuous and interactive knowledge exchange in this field in order to develop the expertise of all parties involved. Dissemination tools were developed to support this continual knowledge exchange, such as a knowledge database with project information, network meetings and site visits to present and discuss results as well as a website (open and closed sections for Special Interest Groups) and a bi-annual newsletter.

From 2008-2010, the NETLIPSE network has run under the TEN-T Annual Programme and now consists of partners from governmental institutions, knowledge institutes and private organisations from 15 European countries, organisations managing and sponsoring the 15 researched projects and other interested organisations involved in sponsoring and realising LIPs in Europe. At the bi-annual Network Meetings representatives from more European member states have participated.

One of the key goals of NETLIPSE is to improve the level of project management of these projects on a European level. Next to the development of the Infrastructure Project Assessment Tool (IPAT) for the assessment of projects, the Network has erected Special Interest Groups where knowledge development and dissemination takes place.

2.3. Special Interest Groups

The NETLIPSE Special Interest Groups (SIGs) are dedicated to researching, developing and disseminating knowledge based on vast experiences of specific topics in the

management and organization of LIPs. Interested members from the network can join or lead a Special Interest Group by organizing or attending group discussions on specific themes, organizing events, presenting at conferences and/or preparing publications, tools etc. Network members can be members of more than one SIG. The SIG is free to decide its own purpose, as long as it corresponds to the overall goal of the NETLIPSE network namely, developing and improving the management and organization of large infrastructure projects in Europe. In the future it is possible that disseminating and developing this knowledge is not solely limited to the European boundaries. For now, this limit is challenging enough.

Each Special Interest Group is coordinated by an Issue Manager. This is an individual who is responsible for keeping the SIG alive and running, i.e. initiating SIG meetings, events and products and finding the topics that will create value for all the SIG members. In order to tackle the chances of being a short lived initiative due to the lack of sustainable and scalable governance mechanisms (as mentioned before), the SIG Issue Manager and its members need to create a value that is recognized by all its members. As of yet, sharing experiences and best practices and carrying out research in teams, has proven very beneficial. As one client representative stated: "participating in the SIG meetings and doing a NETLIPSE case study, has been better than any management training whatsoever".

Depending on the needs of the SIG, various supporting communication tools have been developed such as the internet-based virtual environments and dedicated communities on the website. These sections are open to SIG members only and consist of an archive with relevant articles, publications and presentations, contact information of SIG members, etc. The SIGs meet regularly, at least at every Network Meeting which take place twice a year.

2.4. Current SIGs

The number of SIGs is not limited. If more than two Network members decide it interesting enough to initiate a SIG, they are free to submit a request to the NETLIPSE Board. The Board

decides on the feasibility of a SIG, which may have a temporary nature, i.e. for the research or development of a specific topic, or have a more ongoing nature. As of 2010, there are four SIGs up and running:

1 Business Cases:

Dedicated to discussing the challenges of and developing an effective business case in large infrastructure projects to be used as an important tool in the decision-making phases.

Issue Manager: Matt Dillon, Project Sponsor, Department for Transport, UK.

2 Stakeholder Management & Communication

Dedicated to discussing the challenges of and developing effective stakeholder management & communication tools and approaches for successful execution of large infrastructure projects operating in an ever-increasing influential environment.

Issue Manager: Pau Lian Staal, Quality & Organisation Coordinator North/South Metro Line, Netherlands.

3 Contracting & Tendering

Dedicated to discussing lessons learnt, challenges and developing new insights on effective contracting and tendering strategies for large infrastructure projects.

Issue Manager: Prof.Dr. Konrad Spang, Chair of Projectmanagement, Universität Kassel, Germany.

4 Project Management

Dedicated to improving the quality of the management and organization of LIPs in Europe.

Issue Manager: Prof.Dr. Brane Semolic, Head of Project & Technology Management Institute University of Maribor, Faculty of Logistics, Slovenia.

The enthusiasm of all NETLIPSE Network members is proven to be the cork that the network floats on. Proof of this is the quality of the discussions that have taken and are taking

place, the benefits experienced by the delegates who can translate the experiences of colleagues to their own (national) contexts, the fact that more member states are signing on supporting the network and the increasing number of delegates at general meetings.

3. CONCLUSIONS

In the modern business environment, organizations will establish and maintain their competitiveness not solely by optimizing their own potentials, but more often by being able to use the resources of others and by interconnecting them into an overall process of creating new value. Methods and forms of organizing different modalities of virtual organizations are based on value chain concepts and modern, flexible business models. The described concepts of work can generate value for every involved organization, profit and non-profit, as we could see from practical example of the NETLIPSE program. Governmental organizations can reduce capital expenditures and risks, commercial organizations can increase their competences, knowledge centers actively participate on the "knowledge market" and finally LIP's customers' satisfaction level can be improved.

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INVESTIGATING THE LEVEL OF PROJECT MANAGEMENT CONCEPT IMPLEMENTATION IN SOME SERBIAN COMPANIES

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Abstract: This paper investigates the problems encountered in project management (PM) and project portfolio management (PPM) functions in domestic organizations. The research questions on which this investigation is based are: What is the level of PM methods knowledge and utilization in domestic organizations? And what are the problems and problem areas in implementing the project management methodology in domestic organizations? The answers to these questions are asserted by applying statistical data analysis of the results obtained using a questionnaire survey. An adequate questionnaire was developed as the result of previous investigation of this matter. The obtained results were in accordance with the starting assumptions about the level of PM and PPM implementation in domestic companies. Also, the obtained results can be used as guidelines for further improvement of the PM practice in Serbia.

Key words: Project management, Project portfolio management, Statistical data analysis

1. INTRODUCTION

Nowadays, it is hard to imagine an organization that is not engaged in some kind of project activity.

At the beginning of the 21st century, organizations are turning from operations to project management as part of their competitive advantage strategy (Maylor et al., 2006).

However, in contemporary organizations, in the second decade of 21st century, project management has become an important part of the operations management. The integration of project and operations management has become even larger after adopting portfolio (program) management as the strategic goal of the organization. This way, modern organizations are mostly based on the project (portfolio) organizational structure; with portfolio (project) selection, management and optimization based on best available techniques of operations management.

At the end of 20th century, Pinto and Kharbanda (1996) predicted that project management might replace traditional functional management as the key to competitive advantage in the 21st century. This prediction for certain came right, considering the development of the companies in the Western society (Western Europe, USA, Canada, …).

A conclusion can be drawn, with no doubt, that the process of "projectification" (Midler, 1995) of the Western society companies is certainly complete. This resulted in the situation that now it appears to be few limits to activities or tasks that are termed 'projects'. Each business activity, production and service activity, as well as R&D management activities are now regarded as projects (Mikkola, 2001). This way, the project management process is deeply incorporated in the modern operations of contemporary organizations. The actual and yet not completed process in these companies has been named by Maylor et al. (2006) as

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"programmification". A further evolution of project management knowledge is accordingly directed toward development of sustainable methods for the project portfolio management (or program management) as the part of strategic development of the companies.

This way programme management, or the management of a portfolio of projects, nowadays preoccupies professional project management associations such as the International Project Management Association (IPMA), Project Management Institute (PMI) and the Association for Project Management (APM). As pointed out by Grau (2011), a new standard for programme management will shortly be published by the IPMA. Other two associations, the PMI and APM have been conducting investigations into whether or not they should do the same.

Having this in mind, the project management research community has recently directed increasing attention to a wider context in which projects take place. This is completely understandable having in mind that projects do not start and end in isolation, but they constitute more complex systems with each other and in the business context. Where a number of projects are connected through goal and resource dependencies, we speak about programs (either in the form of project networks or project portfolios).

Programs can be defined as sets of projects and actions purposefully grouped to complete a transformation process and, thereby, realize strategic benefits. In earlier program management literature, there was a strong difference between project network and the project portfolio management (PPM).

Nowadays, this difference is almost nonexistent. Modern project management theory, in recent years, identifies program management with the project portfolio management (Elonen & Artto, 2003).

The reason for this is that in project management literature, programs have been defined and understood in many different ways, over the years. At the beginning, programs have been considered as large complex projects (Graham and Beyond, 2000), collections of

multiple projects used to achieve business benefits (Evaristo & van Fenema, 1999; Payne and Turner, 1999), and as collections of change actions purposefully grouped together to realize strategic and/or tactical benefits (Thiry, 2002).

More current understanding is that a program can be perceived as all of these, and that it cannot be considered just as a scale-up (or chain) of single projects (Lycett et al., 2004; Levine, 2005).

Regardless of the definition and the description of project portfolio management, what is important is the way in which this methodology can help operations management of a company.

Much of the modern portfolio management has been motivated by the seminal work of Harry Markowitz (Markowitz, 1952) and his well known Markowitz optimization approach. Markowitz demonstrated how stock investors could select an efficient set of portfolios that would minimize the standard deviation (risk), subject to a particular portfolio return (expected return) (Walls, 2004). This way the basic assumption of modern portfolio theory is that decisions are made on the basis of a tradeoff between risk and return of each individual project that qualifies to enter the portfolio of the company.

Over the years, providing sufficient tools for individual project evaluation (prior to their inclusion in the portfolio), management of the portfolio, and budget (resource) optimization, enabled PPM to become a powerful methodology for companies operations management. This way, according to Archer and Ghasemzadeh (1999), the project portfolio is defined as a group of projects that compete for scarce resources and are conducted under the sponsorship or management of a particular organization.

The three well-known objectives of portfolio management are: maximizing the value of the portfolio, linking the portfolio to the strategy of the company and balancing the portfolio (Cooper et al., 1998). This way, PPM has grown to be defined as an integrated framework for project portfolio selection, management and optimization.

However, all that was discussed above is describing the situation in project management (PM) and project portfolio management (PPM) in world's practice. The situation in domestic environment, e.g. Serbian companies is, according to our presumptions, much more different. A sad truth is that even the project management is not completely understood in our business environment. This way, our organizations (especially public ones), are far from the process of "projectification". Such a way, speaking about the process of "programmification", in domestic environment is too early.

This way, the main motive for the investigations presented in this paper is in our belief that identifying the PM practice problems and understanding their relationship in the domestic organization provides a basis for overcoming them. The problem identification also enables bringing forth the areas relevant in multi-project management, both in the field of research and in deriving organization specific managerial solutions.

This paper investigates the problems encountered in PM and PPM in domestic organizations. The research questions are:

1) What is the level of PM methods knowledge and utilization in domestic organizations?

2) What are problems and problem areas in implementing the project management methodology in domestic organizations?

Also, if the results of the investigation reveal that the level of project management concept is well developed in some domestic companies, than their switch to portfolio management will be possible in the near future. From the single-project management viewpoint, many studies indicate that project goals and benefit expectations are expanding from single-project level to the portfolio level (Martinsuo & Lehtonen, 2007). Earlier research has suggested that some single-project level factors are related to and possibly contribute to portfolio management efficiency (Mihajlovic et al., 2008). This is why in these investigations, a parallel research was conducted considering both project and project portfolio managements (PM and PPM).

2. METHODOLOGY OF RESEARCH

Our empirical study is based on a questionnaire survey targeted at different industry and service orientated domestic companies. The intent was to identify all organizations in Serbia that have business, production or services activities carried out as projects. The questionnaire was originally sent to 150 Serbian companies and public organizations in the 2008 – 2010 time period. The survey was sent to the person in charge of the project activities in the organization, together with instructions how to conduct the survey. Out of this sample, 120 responded the survey.

The survey was assembled from three parts. The first part contained the so called "demographic" questions (type of the organization, number of employees, organizational structure, number of ongoing projects in the organization, the position of the respondent in the company, the area of his/her involvement). The second and the third parts of the original survey contained 14 groups of questions which can reveal the current situation considering the project and project portfolio management activities in domestic companies. This way, the second part of the survey contained 9 groups of questions dealing with the single project management (PM), while the third part (5 groups of questions) was dedicated to multi project management (PPM). Each group consisted of four to eight questions. The questions included in each group were selected according to the previous experience and relevant literature (Cooper et al, 1998; Martinsuo &Lehtonen, 2007; Levine, 2010).

3. RESULTS AND DISCUSSION

Each question of the original survey was graded by the respondents using a Likert five point scale (1 – I do not agree to 5 – I agree completely). To examine the validity of each group of questions for further statistical analysis Cronbach alpha coefficient was used. According to this criterion, if a group of questions is adequate for further analysis, it is necessary that the Cronbach alpha value exceed 0.7 (Djordjevic et al., 2010).

In our previous investigation, conducted on a smaller population of employees (Mihajlovic et al, 2008) some of the original questions were below this limit, and were accordingly removed from this final survey.

Table 1 consists only of the groups of questions fit to be included into the final questionnaire. The structure of the groups of questions - variables, items included in variables, reliability coefficients and descriptive statistics are presented in Table 1.

According to the values of *Mean*, it can be stated that all important PM and PPM issues are highly rated in domestic organizations. Less value was assigned to the answer to the questions:

Portfolio management supports the strategy process adequately (2.88); *Portfolio management is efficient* (2.81) and *Project portfolio management software is available in the organization* (2.41). This means that less than a half of respondent organizations have some form of PPM software. This is also connected with the fact that the respondents do not think that the portfolio management of their company is efficient and supporting the strategy. Obviously, it isn't possible to manage a portfolio without an adequate software logistics.

On the other hand, many of the respondents do think that the *Management of single project is efficient* (3.71). This finding sustains our previous presumption that domestic organizations are still at the level of PM and not the PPM.

This is a sad truth considering that *More than one projects use common material resources* (4.76); *More than one projects use common human resources* (4.53) and *More than one projects use common financial resources* (4.06). According to this, there is an obvious need for larger PPM techniques implementation in domestic organizations.

Table 1. Variable structure, items included in variables and reliability coefficients

Group of questions (variable)			PM or PPM	Cronbach alpha
Goal settings	Mean	S.D.	PM	0.783
Projects do have clearly defined schedules	4.411765	0.795206		
Projects do have clearly defined scope objectives	4.117647	0.92752		
Projects do have clearly defined costs (budgets)	4.176471	1.014599		
Projects do have clearly defined workload and resource estimates	3.647059	1.114741		
Information availability			PM	0.743
Project managers have all the required information on projects	4	1		
Project managers have truthful information on projects	4.411765	1.064121		
Project managers have up-to-date information on projects	3.823529	1.185079		
Project managers do not receive excess information on projects	4.176471	0.882843		

Systematic decision making			PM	0.812
Formal decision making on starting project planning	3.823529	1.286239		
Formal decision making on starting project execution	4.117647	0.99262		
Formal decision making on projects from one phase to another	3.705882	0.985184		
Formal decision making on project close-up	3.882353	1.053705		
Project goal achievement			PM	0.757
Projects do keep up with the defined schedule	4.176471	0.951006		
Projects do keep up with the defined cost estimate or budget	3.764706	1.300452		
Projects do keep up with the defined work load or resource estimates	3.647059	1.057188		
Project management efficiency			PM	0.856
Management of single projects is efficient	3.705882	1.212678		
Management of single projects offers enough prospects for success	3.705882	1.212678		
Management of single projects focuses on the right issues	4	1.224745		
Way of managing single projects is commonly understood and accepted	3.647059	1.271868		
What is the most important item for single project success			PM	0.759
Clear project goals	4.705882	0.587868		
Availability of adequate information	4.235294	1.032558		
Systematic decision making	3.941176	1.028992		
Top management support	4	1.032796		
Project (or matrix) organizational structure of the company	3.9375	1.062623		
Standardized project management practice in the company	3.75	1.238278		
Synchronization of organizational units in the company	3.75	0.68313		

Project team			PM	0.735
Structure	4.12	0.781		
Coordination	3.94	0.556		
Effectiveness	3.94	0.659		
Leadership	4.41	0.507		
Relations: Team leader – team members	4.12	1.054		
Information flow in the team	4.00	1.000		
Do more than one project in your organizations use same resources			PPM	0.785
More than one projects use common material resources	4.76	0.970		
More than one projects use common human resources	4.53	1.328		
More than one projects use common financial resources	4.06	1.749		
Project portfolio management efficiency			PPM	0.958
The objectives of projects are aligned with strategy	3.75	1.390		
Company strategy is well realized by the projects	3.38	1.544		
Resource allocation to projects is aligned with strategy	3.19	1.167		
Portfolio management supports the strategy process adequately	2.88	1.310		
Priorities across projects are known	3.31	1.401		
The projects yields an optimal return	3.50	1.366		
Portfolio management is efficient	2.81	1.276		
Portfolio management focuses on the right issues	3.12	1.364		
Applying adequate IT systems sustaining the projects			PM; PPM	0.875
Integral IT system exists in the organization	3.47	1.546		
Project manager use a software for project planning/management	3.06	1.391		
Team members use a software for project planning/management	3.00	1.118		

Project portfolio management software is available in the organization	2.41	1.278		

The further analysis included the influence of demographic parameters describing the respondents (or their organizations) on their responses to questionnaire. The first to be analyzed is the influence of the number of employees of the organization upon the responses to the survey. It was determined that the number of employees does have a statistical influence ($p < 0.05$) only on the questions related to project teams efficiency (Table 2). The results of this influence are presented in Figure 1 (a, b, c). As regards all other survey questions, there was no significant influence of the organizations size on the received answers.

Table 2. Results of ANOVA test of the company size influencing the answers on the questionnaire survey

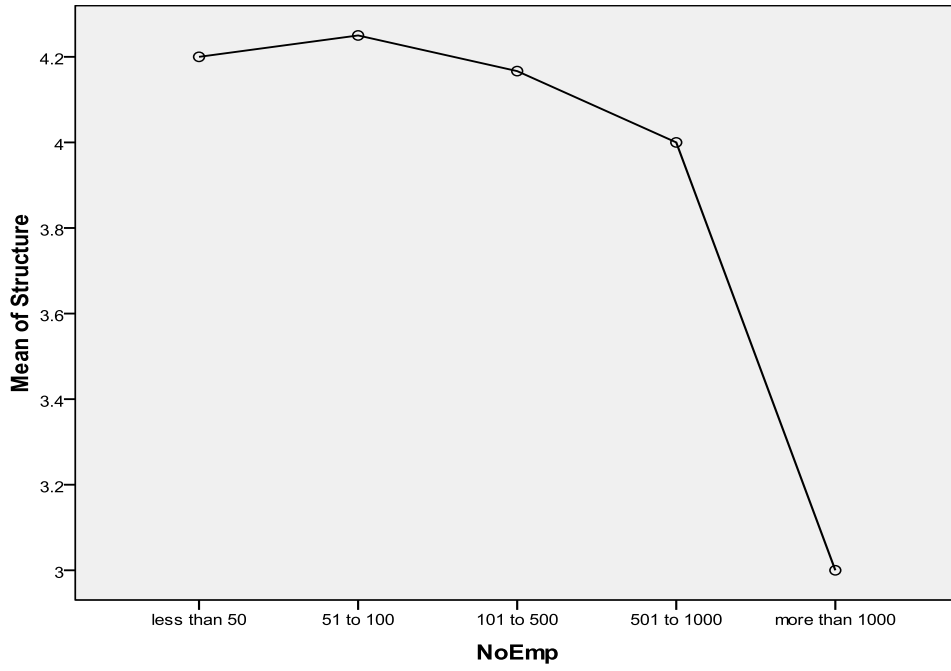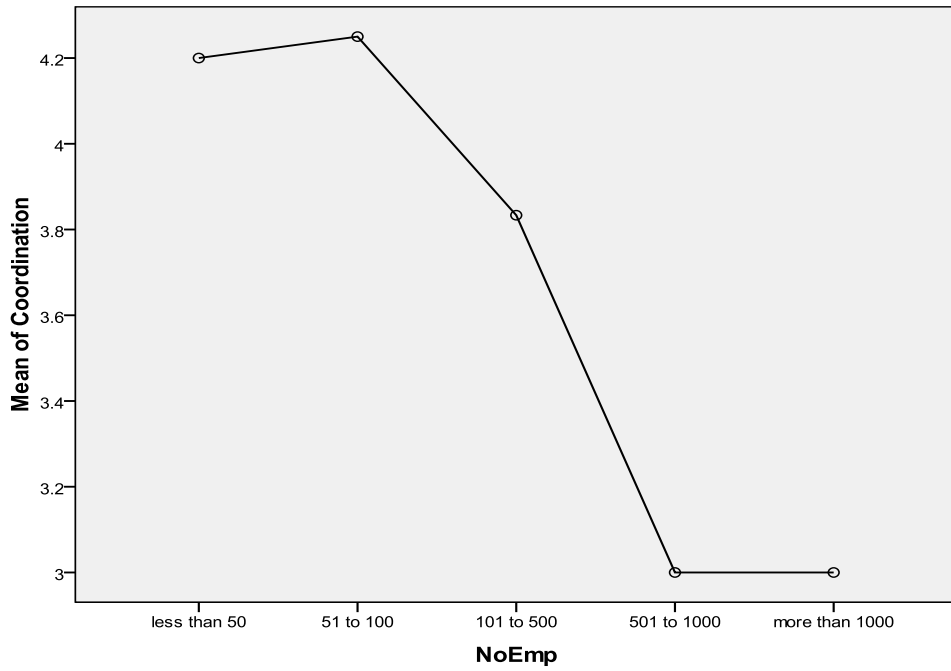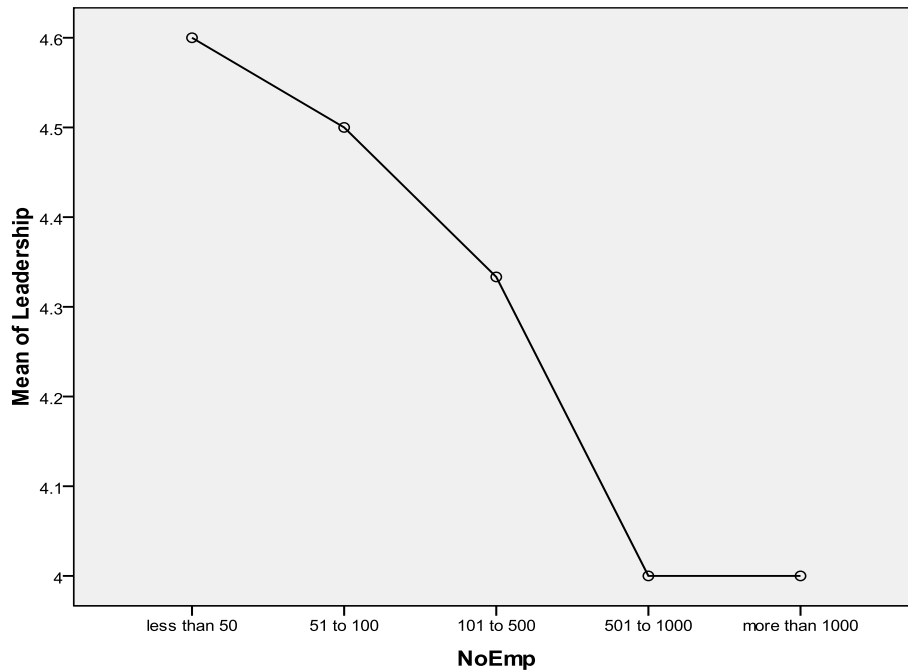|		Sum of Squares	Mean Square	F	Sig.
Project team structure	Between Groups	8.337	2.084	6.051	.007
	Within Groups	4.133	.344		
	Total	12.471			
Project team coordination	Between Groups	2.558	.639	3.220	.042
	Within Groups	2.383	.199		
	Total	4.941			
Project team leadership	Between Groups	35.231	8.808	3.249	.050
	Within Groups	32.533	2.711		
	Total	67.765			

Figure 1a

Figure 1b

Figure 1c

Figure 1. Influence of Organizational size on employees rating the team values: a) Team structure, b) Coordination, c) Leadership

According to the results presented in Figure 1, the importance of the team structure, coordination and leadership is much more emphasized in small organizations, compared to the medium sized and large ones. This can be explained by the fact that large companies included in this investigation are mostly public and state owned firms.

In such an environment team work and coordination are still under the desired level.

Further investigation included the analysis of the influence of the companies' organizational structure on the achieved questionnaire responses. Results of the ANOVA test are presented in Table 3.

Table 3. Results of ANOVA test of the companies' organizational structure influencing the answers on the questionnaire survey

		Sum of Squares	Mean Square	F	Sig.
Project managers have truthful information on projects	Between Groups	6.750	3.375	5.108	.022
	Within Groups	9.250	.661		
	Total	16.000			
Availability of adequate information	Between Groups	5.763	2.882	3.572	.050
	Within Groups	11.295	.807		
	Total	17.059			
Project managers use a software for project planning/management	Between Groups	15.146	7.573	6.712	.009
	Within Groups	32.533	2.711		
	Total	67.765			

Project portfolio management software is available in the organization	Between Groups	11.731	5.866	5.708	.015
	Within Groups	14.386	1.028		
	Total	26.118			

According to the results presented in Table 3, it is obvious that the type of organizational structure of the company is influencing therespondents' answers regarding the information flow and using the software application on the project. The type of the influence is presented in Figure 2 (a – d).
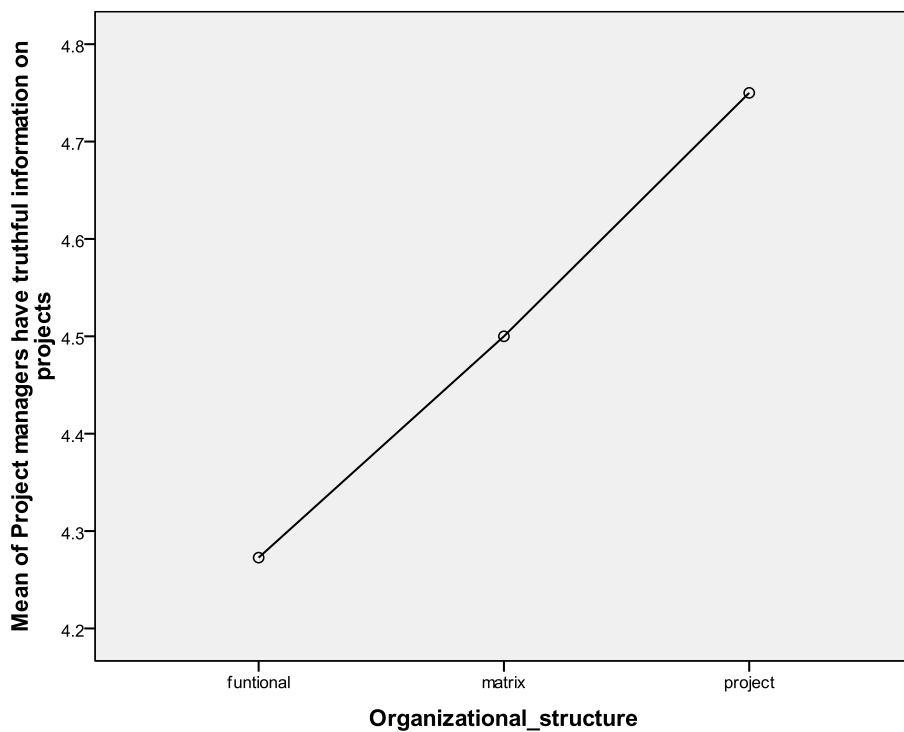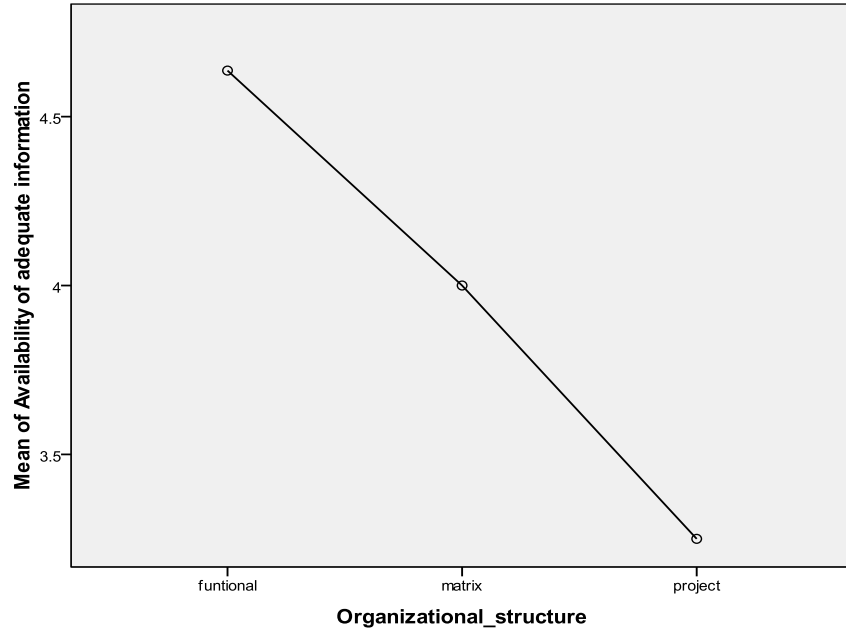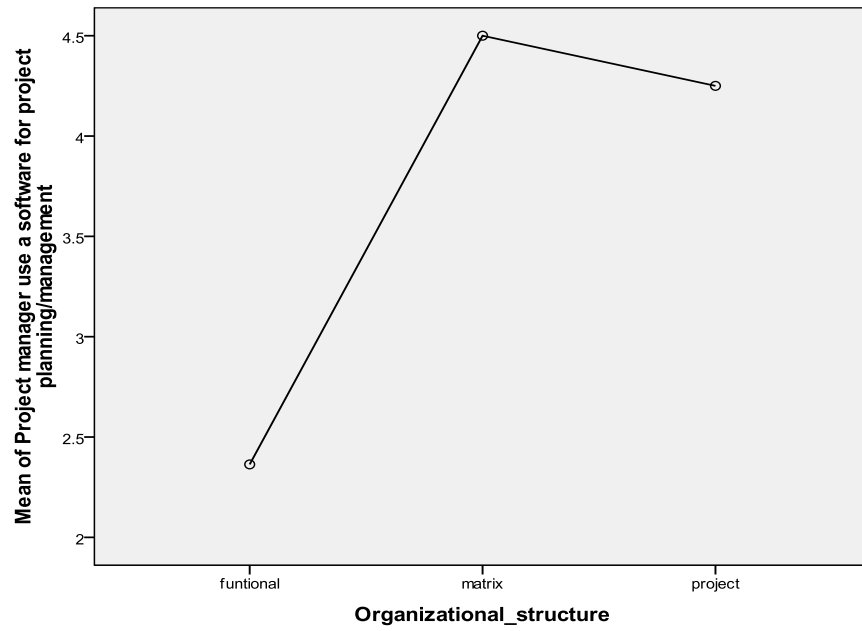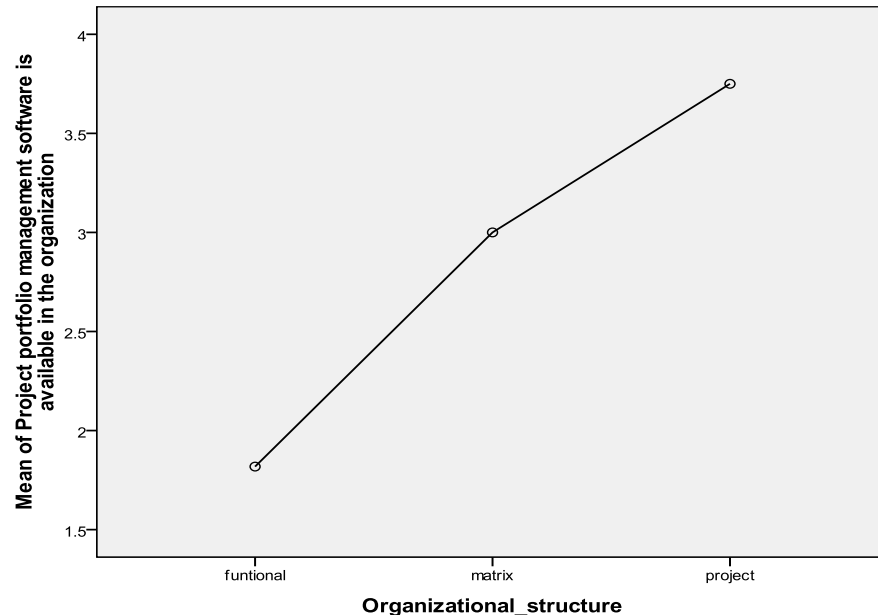
Figure 2a

Figure 2b

Figure 2c

Figure 2d

Figure 2. Influence of Organizational structure on employees' rating the information flow and IT application on the projects: a) Truthful information, b) Availability of information, c) using the project planning software; d) availability of the PPM software

Employees who work in the companies with the functional organizational structure do have less belief that their managers receive truthful information on the project, compared to their colleagues from the companies with matrix and project structure (Fig 1.a). This is understandable considering the difference in the type of information flow among these tree types of organizational structures. On the other hand, functional organization employees do appreciate the value of availability of the adequate information, compared to their colleagues (Fig 1.b). Project managers from the project and matrix oriented organizations use

PM software more than managers in functional organizations (Fig 1.c). The situation is the same with the availability of PPM software in the organizations.

The next issue that was analyzed was the influence of the respondents' position in the project team on his/her answers to the survey. The obtained results are presented in Table 4. According to the results, it is obvious that the position in the team does influence the respondents' perspective on leadership and relations between team leader and team members. The type of the influence is presented in Figure 3.

Table 4. Results of ANOVA test of the respondents' position in the project team influencing the answers on the questionnaire survey

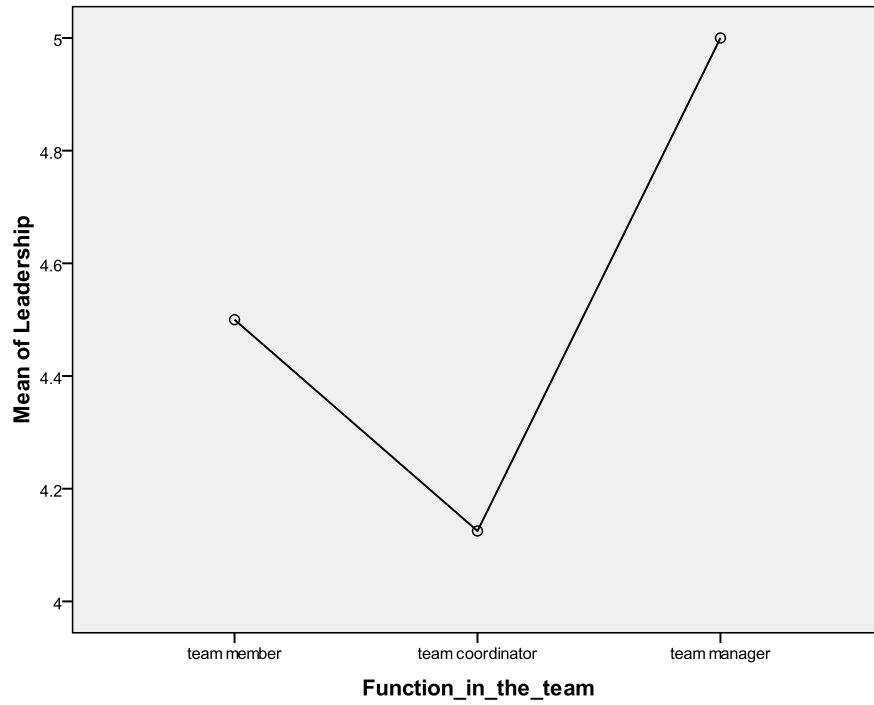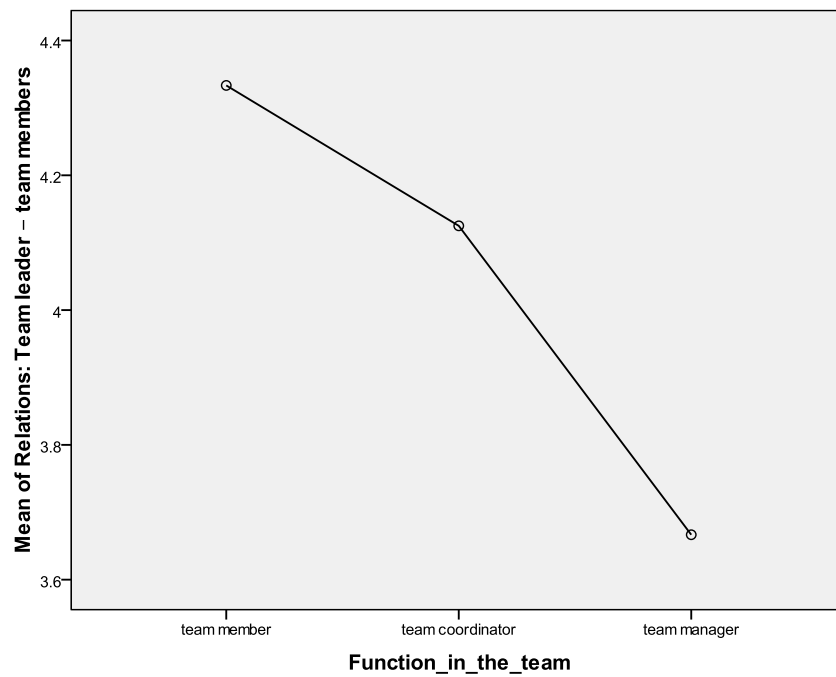|		Sum of Squares	Mean Square	F	Sig.
Leadership	Between Groups	1.743	.871	5.136	.021
	Within Groups	2.375	.170		
	Total	4.118			
Relations: Team leader – team members	Between Groups	.890	.445	.369	.042
	Within Groups	16.875	1.205		
	Total	17.765			

Figure 3a

Figure 3b

Figure 3. Influence of team function on employees rating the importance of leadership and relations within the project team: a) leadership, b) Relations: Team leader – team members

Leadership is considerably more highly rated by the team manager, compared to the project team members (Fig. 3. a). The team members, on the other hand, highly rate the relationship between them and their team manager (Fig 3. b). This can be explained by the difference in the perspectives between these two groups. The team managers are also leaders, and this is why leadership is most important to them. Team members expect to have positive relations with their leader (e.g. team manager).

On submitting all statistically significant variables to the interdependence correlation analysis, the results presented in Table 5 were achieved. According to correlations obtained, the following relations can be proposed:

R1: *Project portfolio management software is available in the organization* is related to the *Project manager use a software for project planning/management* ($r^2 = 0.724$; $p = 0.001$)

R2: *Project manager use a software for project planning/management* is related to the *Availability of adequate information* ($r^2 = 0.489$; $p = 0.046$)

R3: *Leadership* is related to *Coordination* ($r^2 = 0.535$; $p = 0.027$)

The fact is that in all the organizations that invested in purchasing an adequate PM software, managers are using this tool (R1). This of course leads to a larger availability of adequate information on the project, considering the fact that PM software usually can store large amounts of data in the database and that the data acquisition and processing is much easier using the software (R2). The coordination of tasks between team members is one of the project manager functions. This is why it is strongly related to leadership as one of the project managers attribute (R3).

Table 5. Pearson correlation among statistically important variables

		Project managers have truthful information on projects	Availability of adequate information	Project managers use a software for project planning/management	Project portfolio management software is available in the organization	Structure	Coordination	Leadership	Relations: Team leader – team members
		Correlations							
Project managers have truthful information on projects	Pearson Correlation	1	-.151	.278	.327	.464	.149	-.218	-.157
	Sig. (2-tailed)		.564	.279	.200	.060	.568	.401	.546
Availability of adequate information	Pearson Correlation		1	**.489**[*]	-.173	.351	-.083	-.197	.605[*]
	Sig. (2-tailed)			.046	.507	.167	.751	.450	.010
Project managers use a software for project planning/management	Pearson Correlation			1	**.724**[**]	-.179	.086	.141	-.218
	Sig. (2-tailed)			6	.001	.491	.744	.590	.400

							1	.011	-.052	.011	-.038
Project portfolio management software is available in the organization	Pearson Correlation										
	Sig. (2-tailed)							.966	.844	.966	.884
Structure	Pearson Correlation							1	.161	.028	.438
	Sig. (2-tailed)								.537	.916	.079
Coordination	Pearson Correlation								1	**.535**[*]	.439
	Sig. (2-tailed)									.027	.078
Leadership	Pearson Correlation									1	.254
	Sig. (2-tailed)										.324
Relations: Team leader – team members	Pearson Correlation										1
	Sig. (2-tailed)										
*. Correlation is significant at the 0.05 level (2-tailed).											
**. Correlation is significant at the 0.01 level (2-tailed).											

4. CONCLUSIONS

Upon the development of the questionnaire scale that can be used for the assessment of the level of PM and PPM implementation in domestic companies, it was used to analyse the results presented in this paper. Accordingly, the most important obstacles in a further rise of PM and PPM practice were determined, depending on the number of employees and organizational structure of the company, as well as on the respondents' position in the project management team.

What can be concluded is that the project management concept is on a much lower level of development in large public companies with functional organizations structure. The availability of PM (or PPM) software tools is also rare in such companies. On the other hand, private firms, which are usually SMEs are much better organized and equipped considering the PM concept.

The results presented in this paper are the basis of our further investigation on the PPM model development and the PPM model competence.

Using the questionnaire developed in this paper, a larger group of company employees will be

surveyed. This will alow for defining the model of structural equation for calculating the level of the single project and project portfolio success, based on the key issues rating by the respondents. For an investigation of this size, companies from surrounding countries will be included, considering the similarities in our business environments.

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CYCLIC STOCHASTIC ALTERNATIVE NETWORK MODELS FOR PROJECT MANAGEMENT

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Abstract: The paper describes a new class of network models adequately reflecting the complex project realisation process that are used for stating and solving optimal management tasks for this project. This class of models is a synthesis of generalized network models (with their rich spectrum of means for equivalence conversion of models (Voropaev, 1975; Voropaev, 1986; Voropaev et al. 1990; Voropaev & Ljubkin, 1997; Voropaev et al., 1999c) and describing the different logical and time interrelations between of project activities) with probabilistic (Golenko, 1969) and stochastic (Philips & Garcia-Dias, 1984) models to a considerable extent taking into account factors of risk and uncertainty the implementation of a project involves. These models (further referred to as cyclic alternative network models – CANMs) are the most flexible and adequate in the range of known tools for describing the process of managing and control over the development of a complex sophisticated project. CANMs offer all the advantages of generalised and stochastic models in comparison with traditional network models while at the same time involving just a slight complication of the language used for describing CANMs.

Key words: Classical network models; Generalised network models; Probabilistic network models; Stochastic network models; Cyclic alternative network model

1. INTRODUCTION

The paper describes a new class of network models adequately reflecting the complex project realisation process and used in stating and solving optimal management tasks for this project. Each of the projects has a number of characteristics significant for the analysis using the methods, tools and means presented in this paper:

- the project consists of a certain set of interrelated activities the completion of which (all or a certain subset) means the completion of the project;

- the activities are partially ordered, i.e. must be implemented in a certain technological order;

- taking this order into account activities may start and finish independently of one another;

- some of the parameters of these activities are exposed to various random effects, they are, therefore, random in character;

- the technological order itself may very often depend on randomness and be of stochastic (alternative) nature.

Thus, we are considering the problem of project implementation process scheduling as a set of interrelated activities under the conditions of risk and uncertainty.

Besides, when stating and solving scheduling problems it is often necessary to take into account the scarcity of some resources or requirements for the dynamics of their consumption (for instance, the uniformity requirement). Moreover, some resources can be accumulated whereas it may be impossible to stock other resources in principle.

A high degree of complexity and laboriousness in drawing up timing schedules for numerous activities performed by many project members using a great range of resources, strict requirements for the quality of plans, the need for regular control of their fulfillment and adjustment call for the proper methods of solving problems of such sophisticated nature.

Project implementation process modeling is the main active methodological body of the Project Management tools (Voropayev, 1997). The efficiency of decisions made and the whole functioning of the Project Management system is determined by the adequacy of models for real processes and their meeting the requirements of project management tasks and goals.

The current mathematical methods of modeling project processes (classical network models (Zuhovitsky & Radchik, 1965), generalized (Voropayev, 1975; Vorobayev et al. 1986; Voropayev, 1990), probabilistic (Golenko, 1969) and stochastic (Philips & Garcia-Dias, 1984) network models) do not always appear adequate to the complex reality of the modelled process. It should be noted that it refers to each method taken separately and to some combinations of these methods.

The model presented in this paper for project management is a synthesis of generalized network models (with their rich spectrum of means for equivalence conversion of models (Voropayev et al. 1997a; Voropayev et al., 1999c) and for describing the logical structure of the set of project activities) with probabilistic and stochastic models to a considerable extent taking into account factors of risk and uncertainty the implementation of a project involves. These models (further referred to as *cyclic alternative network models – CANMs*) are the most flexible and adequate tool for describing the process of managing and control over the development of a complex sophisticated project. CANMs offer all the advantages of generalised and stochastic models in comparison with traditional network models while at the same time involving just a slight complication of the language used for describing CANMs. By that we mean the user's

language of communication, means available to project managers (at different management levels) for describing projects, for participating in the interactive generation of timing schedules.

According to the three-dimensional classification of network models given in (Voropayev et al. 2000) CANMs fall under the most general category of cyclic stochastic alternative models.

Thus, according to (Voropayev et al. 2000) all known kinds of network models are a particular case of CANMs. In this connection the body of models and algorithms proposed herein can be taken as the basis of the development of a universal set of Project Management Software for multilevel network systems in project management with any degree of project complexity (Voropayev et al. 1999a; Voropayev et al.,1999b; Voropayev et al.,1997a;Voropayev et al., 1999c).

2. CANM DESCRIPTION

The CANM is a finite oriented cyclic graph G (Ω,A) consisting of a set of events Ω and arcs (i, j) $(i, j \in \Omega)$ defined by the adjacency matrix $A=\{p_{ij}\}$. $0 \leq p_{ij} \leq 1$, while $p_{ij} =1$ defines determinate arc (i, j), and $0< p_{ij} <1$ determines the alternative event i which is connected with the event j by an arc with the probability p_{ij}. The set of arcs is divided into activity-arcs and link-arcs. The former denote a certain production output in the course of time, the latter exclusively reflect a logical relationship between activities. An event can be the starting or the finishing time of activities fulfilled as well as some of their intermediate states.

Let T_i denote the time of event i, then the relation between the E of events connected with the arc (i, j) is assigned by an inequation:

$$T_j – T_i \geq \psi_{ij}, \qquad\qquad (1)$$

where ψ_{ij} in the general case is a random variable distributed according to a certain law within the interval from $- \infty$ to 0 or from 0 to $+\infty$.

Besides, absolute constraints are possible to appear at the moment of the event i occurrence:

$l_i \leq T_i \leq L_i.$ (2)

The correlation (1) – (2) is the generalization of the appropriate inequations when generalized network models (Voropayev, 1975) where ψ_{ij} parameter and adjacency matrix A have a determinate pattern.

Let us consider the interpretation of correlation (1) provided the parameter ψ_{ij} is of a probabilistic nature.

If (i,j) is an activity-arc (or part of it) then the positively distributed random variable defines the distribution of the minimum duration of this activity (related to the maximum saturation of it with the determinant resource). Planning the maximal possible utilization of the resource for the activity we anticipate the fulfillment of the activity in the shortest possible time; contingencies and unforeseen complication and hindrances, however, condition the probabilistic character of this time; moreover, the mode (the most probable minimum time of the activity fulfillment) shifts to the right relative to the mathematical expectation as a rule.

As a result of it the distribution of the variable ψ_{ij} is unimodal and asymmetric, and the type of distribution satisfying the requirements of the beta-distribution that was intuitively introduced for the estimation of activity duration in the PERT system first (Philips & Garcia-Dias, 1984) and then was analytically and empirically validated and proved (Golenko. 1969).

Thus, the minimum activity duration is a random variable $\psi_{ij}=t_{min}(i,j)$ distributed according to the law of beta-distribution in the interval [a,b] with probability density

$\Phi(t)=C(t-a)^{p-1}(b-t)^{q-1},$ (3)

In which C is determined in such manner that $\int_a^b \varphi(t)dt=1$.

In [2] it is shown that parameters of ψ_{ij} distribution – $M\psi_{ij}$ and variance $\sigma^2\psi_{ij}$ - are approximately distributed according to the formulas:

$M\psi_{ij}=(a_{ij}+4m_{ij}+b_{ij})/6,$ (4)

$\sigma\psi_{ij}=(b_{ij}-a_{ij})/6,$ (5)

in which a_{ij}, b_{ij}, m_{ij} respectively are the optimistic, the pessimistic and the most probable estimates of the activity duration (i,j) prescribed by its executives (when using the three-estimates methodology). If the two-estimates methodology (proposed and substantiates in [6]) the probability density has the following form:

$\varphi(t)=C(t-a)(b-t)^2,$ (6)

where $C=12/(b-a)^4$ and the distribution parameters

$Mt=(3a+2b)/5,$ (7)

$m=(2a+b)/3,$ (8)

$Dt=0.04(b-a)^2.$ (9)

If the random variable ψ_{ij} in (1) corresponding to the activity-arc (i, j) is distributed in the interval from $-\infty$ to 0 then $-\psi_{ij} = t_{max}(j, i)$ assigns the distribution of the maximum duration of activity (j,i) (determined by the minimum saturation of it with the determinant resource). Applying to this variable the same procedure as the above described one we will obtain its distribution in the form (3) or (6) and the parameters calculated with (4)-(5) or (7)-(9) formulas, respectively.

Assuming the most probable values (modes) as the values of these random variables we obtain in the particular case the known two-estimates probabilistic model (described in (Golenko, 1969)) in which $a_{ij}=mt_{min}(i,j)$ and $b_{ij}=mt_{max}(i,j)$. Thus, the introduction of negatively distributed variables ψ_{ij} for activity-arcs (i,j) into (1) considerably extends the possibilities of describing the time characteristics of activities which makes the widely used probabilistic model just one of particular cases.

For link-arcs (i,j), the variable ψ_{ij} assigns the distribution of the time dependence of events i and j, while the positively distributed variable ψ_{ij} determines the interconnection of "no sooner" kind (event j can occur no sooner than in ψ_{ij} days after the occurrence of event i) and the negatively distributed variable ψ_{ij} determines the interconnection of "no later" kind (event i can occur no later than $-\psi_{ij}$ days after the occurrence of event j).

In the latter case these links are called "reverse" (Voropayev, 1975).

In (Voropayev, 1975) the wide opportunities available for setting technological links between activities using determinate parameters of ψ_{ij} are described in detail; herein we deal with the generalization of these links which takes into account their possibly probabilistic character.

As the time of events T_i is calculated as the total duration of activities technologically preceding these events then if the number of these activities is rather large, the distribution of the random variable T_i tends - according to the central limit theorem - to the normal distribution with the following parameters: mathematical expectation MT_i and variance DT_i.

The normal distribution should also be anticipated for the parameter ψ_{ij} corresponding to the "reverse" arcs which is also proved by the statistical analysis (Golenko, 1969).

Absolute constraints on the time of events assigned by (2) reflect the relevant directive, organizational and technological constraints on the times of accomplishing the activities or their elements set on the "absolute" (real or conventional) time scale. Absolute constraints are also characterized by the "no sooner" and "no later" types. The value of l_i and L_i are non-negative on the absolute scale. If we call the reference time (absolute or relative) a zero event, then we can introduce arcs $(0,i)$ and $(i,0)$ with $\psi_{0,i}=1$ and $\psi_{i,0}=-L_i$ parameters respectively and (2) reduce to the form of:

$T_i - T_o \geq l_i$, $T_o - T_i \geq -L_i$.

Thus, absolute constraints of the (2) type are the particular case of constraints of (1) type for certain link-arcs.

Let us study now some additional opportunities for the description of the process of the complex and sophisticated project development that become available due to the introduction of

a stochastic adjacency matrix A in combination with generalized links.

Let $L(i,j)$ be a certain path linking the events i and j.

$$L(i,j)=\{i=i_o \rightarrow i_1 \rightarrow i_2 \rightarrow \ldots \rightarrow i_v=j\}. \qquad (10)$$

Let us call a path determinate if for all $k \in [1,v]$ the following holds true: $pi^{k-1}i^k=1$, and stochastic if it does not. Thus, by definition, the stochastic path contains at least one arc the probability of "occurrence" of which is rigorously lower than 1. By the "occurrence" of an arc we mean here the completion of activity (for an activity-arc) and the fulfillment of requirements for the time connection of events (for link-arcs).

Let us define in the same way the determinate and the stochastic loop $K(i)=\{i=i_o \rightarrow i_1 \rightarrow i_2 \rightarrow \ldots \rightarrow i_v=i\}$. (let us call such events i "loop").

Let the events i and j be linked by the path $L(i,j)$. Then the probability $P(j/i)$ of the J event occurrence on condition that the event i has occurred is the production of the A adjacent matrix coefficients corresponding to the arcs of the linking path:

$$P(j/i)=\Pi_{k=1}^{v} pi^{k-1}i^k. \qquad (11)$$

If events i and j are linked by several paths, an equivalent GERT-transformation of this network fragment is made in accordance with the formulas given in (7), the generating function $\Psi_{ij}(s)$ is calculated and the probability of the event j on condition that the event i has occurred is $P(j/i)=\Psi_{ij}(0)$.

The first derived function $\Psi_{ij}(s)/\Psi_{ij}(0)$ with respect to s at point $s=0$ (the first moment $\mu_1(j/i)$) determines mathematical expectation $M(j/i)$ of the event j time with respect to the event i time. The second derived function $\Psi_{ij}(s)/\Psi_{ij}(0)$ with respect to s at point $s=0$ (the second moment $\mu_2(j/i)$) allows to calculate the variance of the event j time with respect to the event i time by the following formula:

$$\sigma^2(j/i)=\mu_2(j/i) - (\mu_1(j/i))^2. \qquad (12)$$

The GERT-transformation of a net fragment can be applied to the calculation of the probability of the event j linked by stochastic paths with one node i to which a determinate full path leads. If stochastic paths from different alternative nodes i lead to the event j, in this case the following recurrent correlations are suggested:
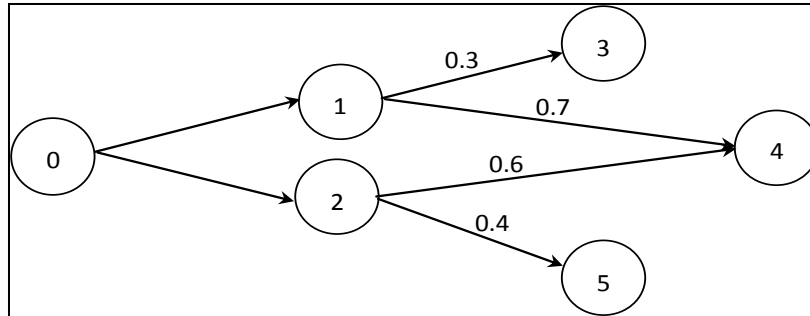

Figure1. Example of stochastic model

Here $P(0)=P(1)=P(2)=1$. The GERT-transformation is not applicable to the calculation of P(4) (0.7+0.6=1/3>1). According to (13):

$P(4)=1 – (1 – 0.7)(1 – 0.6)=0.88$.

Below, another simulation method of determining the probability of events is suggested. It is more effective for a larger network (number of arcs more than 300).

The path length $L(i,j)$ is a random variable the mathematical expectation $ML(i,j)$ of which is a sum of mathematical expectations of the lengths of all arcs constituting this path, and variance $DL(i,j)$ is equal to the sum of variances. Mathematical expectations of the lengths of arcs are calculated by formulas (4) or (7) and variances – by formulas (5) or (9) for three- or two-estimates methodologies respectively.

Under these conditions the path (loop) length may take negative values which is interpreted in the following way (let us study an example of a determinate loop given in Fig.2):
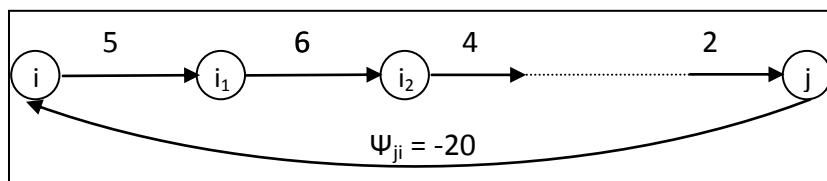
Figure 2. Example of a determinate loop

In this case the event j must occur no later than $-\psi_{ji}$ days after the occurrence of the event i.

As distinct from the generalized network models (Voropayev, 1975), the parameter ψ_{ji} is probabilistic in character, which allows for the logical-time relationship between events to be more flexibly described.

3. STATEMENT OF CANM TIME ANALYSIS PROBLEMS

The CANM time analysis problems as well as the time analysis of classical, generalized or stochastic network models form the basis of solving all the scheduling problems for project management. They are of particular significance themselves when dealing with project management without taking into

account constraints on resources which are used in the creation of unique projects or projects of special importance.

Time analyses problems can also be separately used to generate different plan variants at certain values of the resources availability vector with the objective of their further comparison, plan variants quality evaluation and selection of ways and directions of their further improvement.

When solving any optimum scheduling problems CANMs time analysis algorithms are applied as an instrument for calculating the required parameters used in the relevant optimization algorithms.

CANMs time analysis problems come to finding random vector $T=(T_0,T_1,\ldots,T_n)$ where T_i is the occurrence time of the event i the coordinates of which satisfy inequations (1)-(2) and make certain the efficiency function $F(T)$ goes to the extremum.

As $\{T_i\}$ here are random variables, CANMs time analysis problems are characterized not only by the type of function $F(T)$ but also by the method of calculating $\{T_i\}$ and their parameters.

Owing to this, let us single out the three categories of time analysis problems:

- *classical* which use mathematical expectations of all arc lengths for $\{T_i\}$ calculation;

- *probabilistic* which calculate – on the basis of Liapunov central limit theorem or other mathematical tools – mathematical expectations $\{MT_i\}$ of events i times being the arguments of efficiency function $F(T)$;

- *statistical* which determine for the given confidence level p on the basis of methodology (Golenko, 1969) p-quantile estimates of empirical distribution of the times of events i – $\{W_p(T_i)\}$ – as well as values derivative of them and the values of efficiency function $F(W_p(T))$ where $W_p(T)= \{W_p(T_0), W_p(T_1),..,W_p(T_n)\}$

The form of efficiency function $F(T)$ allows for the calculation of different types of plans (early, late, shortest possible and etc.) as well as a number of the required parameters (critical path, time reserves) for their further separate or auxiliary use.

4. CANM CONSISTENCY CONCEPT

The cyclic alternative network model is called consistent if there is at least one feasible plan calculated for the relevant category of time analysis problems (classical, probabilistic or statistical) satisfying the set of ineqations (1)-(2).

Let us study these three concepts individually.

4.1.Classical model consistency

The mathematical expectations of all arc lengths are calculated by the relevant formula (7), (4) (in the two- or three-estimates methodology) and assign a network with constant arc lengths. In the theory of classical network models (Zuhovitsky, 1965) it is shown that the requisite condition of the model consistency has no loops in it.

Taking into account the stochastic character of the model under consideration and the fact that it has generalized links in it, there may be stochastic and determinate loops (cycles) in the CANM after doing the above-described calculations.

Lemma 1. For any confidential level α assigned in advance the presence of a stochastic loop does not result in the inconsistency of the model, namely we can state that the model will be consistent with probability α.

Proof.

Let loop $K(i)$ and probability $P(i/i)<1$ of passing through it be assigned. The probability of leaving the loop for k-fold passage over it is calculated by the following formula: $1 – P^k(i/i)$. Taking this as the basis we calculate the number of possible times k of passing the loop after which we leave it with probability α: $α=1 - P^k(i/i)$, therefore

$$k=\ln(1-α)/\ln P(i/i). \tag{14}$$

For instance, for $α=0.95$ and $P(i/i)=0/4$ we obtain $k≈3$, i.e. after passing through the loop three times we will leave it with probability equal to 0/95.

When determining (with probability α) a feasible time of the event j identified with the leave the loop, the length of the path going through the event i up to the event j should be summed up with $kL(K(i))$ where $L(K(i))$ is the length of the loop $K(i)$.

Lemma 2. In order to make the alternative model, for which arc lengths were calculated according to the classical procedure to be consistent, it is necessary and sufficient that the lengths of all the determinate loops (provided that there are no stochastic ones) be non-positive, i.e. $L(K(i)) \leq 0$ for all "loop" i.

Proof.

If the arc lengths are calculated according to the classical scheme and there are no stochastic loops, we obtain a generalized network model for which the statement contained in lemma 2 is rigorously enough proved in (Voropayev, 1975).

Theorem 1. For the cyclic alternative model with arc lengths calculated according to the classical procedure to be consistent with a given probability α, it is necessary and sufficient that the lengths of all the determinate loops be non-positive.

The proof of the theorem follows directly from the joint application of lemma 1 and lemma 2.

4.2. Probabilistic Consistency of the Model

We calculate the mathematical expectation MT_i and variance $\sigma^2 T_i$ of event times using the formulas from (Golenko, 1969). It should be noted that the values of parameters calculated by such analytical method are 15-20% different from those calculated by the classical method (on the basis of mathematical expectations of arc lengths).

We shall mean the *probabilistic inconsistency of the model on average* provided that the set obtained in the above-described way satisfies inequations (1)-(2) in which the mathematical expectation of ψ_{ij} is taken as its value.

Theorem 2. For the cyclic alternative model to be probabilistically consistent on average it is necessary and sufficient that the mathematical expectations of the lengths of all determinate loops be non-positive.

Proof.

Let $K(i)$ be the loop and $ML(K(i))$ be the mathematical expectation of its length. Then the efficiency function of moments for $K(i)$ loop is $M_{ii}(s)=e^{sML(K(i))}$. The first derived function $M_{ii}(s)$ with respect to s for s=0 (characterizing the mathematical expectation of the loop length) is an odd function with respect to the sign of the loop length. Function $\Psi_{ii}(s)=p_{ii}M_{ii}(s)$ is, therefore, odd in the same sense, p_{ii} being the probability of "entering" the loop and $P_b=1-p_{ii}$ being the probability of "leaving" it. As the efficiency function of the equivalent fragment is

$$\Psi_{ij}(s)= \Psi_b(s)/(1- \Psi_{ii}(s)), \qquad (15)$$

then for $p_{ii}<1$ we obtain:

$$p_{ij}=\Psi_{ij}(0)= \Psi_b(0)/(1- \Psi_{ii}(0))=(1-p_{ii})/(1- p_{ii})=1, \qquad (16)$$

i.e. we leave the stochastic loop with probability 1.

In order to determine the mathematical expectation of the equivalent fragment length let us calculate the first moment of (15) at the point s=0:

$$M_1(j/i)=[p_b(1-p_{ii})ML(i,j)+p_bp_{ii}ML(K(i))]/(1-p_{ii})^2=$$

$$=ML(i,j)+ML(K(i))[p_{ii}/(1-p_{ii})] \qquad (17)$$

Thus, in order to determine the average time of the event j identified with leaving the loop it is necessary to add the length of the path going through the event i to the event j to $\delta L(K(i))$ where $L(K(i))$ is the length of loop $K(i)$, and $\delta=[p_{ii}/(1-p_{ii})]$.

If the loop is determinate ($p_{ii}=1$) then for positive values of $\Psi_{ij}(s)$ and its derivative from (17) we can see the impossibility of leaving the loop (infinity of the equivalent fragment length). For a non-positive loop length $ML(K)i))$ we have the probability of leaving it equal to 1 and the equivalent arc length lying within the interval from $NL(i,j)$ to $ML(i,j)+|ML(K(i))|$.

Proceeding from the assumption that T_i has normal distribution with the following parameters: mathematical expectation – MT_i and variance – $\sigma^2 T_i$ let us introduce a wider concept of *ε-probabilistic model consistency*.

Let us say that the CANM is ε-probabilistically consistent if there is ε>0 so that for all T_i satisfying the inequation $|T_i - MT_i|<\varepsilon$ correlations (1)-(2) hold true.

Theorem 3. For s cyclic alternative model to be ε-probabilistically consistent it is necessary and sufficient that the mathematical expectations of the lengths of all the determinate loops satisfy the following correlation: $ML(K(i))\leq -4\varepsilon$.

Proof.

Let $K(i)$ be the loop and $ML(K(i))$ be the mathematical expectation of its length.

Let us single out the "positive path" and the "reverse" arc and without loss of generality do an equivalent GERT-transformation of this network fragment reducing it to the form presented in Fig. 3.
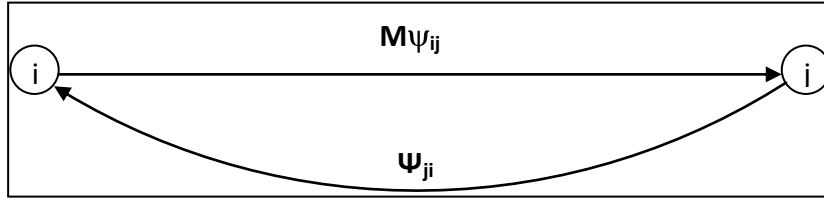

Figure 3. Network fragment with the "positive" and the "reverse" arcs

Here $M\psi_{ij}$ is the mathematical expectation of the "positive" part of loop $K(i)$.

Let correlation (1) hold true for T_i and T_j satisfying inequations:

$$|T_i\text{-}MT_i|<\varepsilon, |T_j\text{-}MT_j|<\varepsilon, \qquad (18)$$

then they hold true for the extreme values of T_i and T_j minimizing the left part of (1), i.e. for

$T_i=MT_i\ M\psi_{ij}\pm\varepsilon$ and $T_j=MT_j\pm\varepsilon$:

$$MT_j\text{-}\varepsilon - (MT_i+\varepsilon)\geq M\psi_{ij} \text{ and } MT_i - \varepsilon - (MT_j+\varepsilon)\geq M\psi_{ji}. \qquad (19)$$

Adding up the inequations we get the following

$-4\varepsilon \geq M\psi_{ij}+ M\psi_{ji} \approx ML(K(i))$ which proves the necessity of the statement of theorem 3.

In order to prove the sufficiency, let $T_j=T_i+M\psi_{ij}$. The inequation (1) for arc (i,j) remains valid. We have $T_i - T_j=- M\psi_{ij}$.

As $M\psi_{ij}+ M\psi_{ji}\approx ML(K(i))\leq -4\varepsilon$ then $- M\psi_{ij}\geq 4\varepsilon+ M\psi_{ji}\geq M\psi_{ji}$, from which follows the validity of inequation (1) for arc (i,j).

Let us give a small numerical example illustrating the validity of theorem 3. Let

$MT_{i=}50$, $MT_j=100$ for the network fragment presented in Fig.3. Let us assume ε=1 (one day). The correlation (1) for arc (i,j) must be valid for all T_i and T_j satisfying inequations (18) which means that it must also be valid for those T_i and T_j which minimize the left part of (1), i.e. for $T_i=50+1=51$ and $T_j=100 – 1=99$.

It follows that the following inequation must hold true $M\psi_{ij}\leq T_j - T_i=99 – 51=48$. On the other hand, studying the "reverse" arc (j,i) and applying the same procedure we come to the validity of (1) for arc (j,i) for $T_i=50 – 1=49$ and $T_j=100+1=101$. Inequation $M\psi_{ji}\leq T_i - T_j =49 – 101= -52$ must, therefore, also be valid.

Adding up these inequations we finally get the required correlation:

$$M_{\Psi ij}+ M_{\Psi ji}\approx ML(K(i))\leq 48 – 52= -4 = -4\varepsilon.$$

The probabilistic consistency of the model on average is a particular case of ε-probabilistic consistency for ε=0.

4.3. Statistical consistency of the model

When using the statistical method of calculating the parameters of a network model we deal with p-quantile estimates of their values being the

theoretical-probabilistic analogues of the relevant parameters (Golenko, 1969).

Let us say that a cyclic stochastic model is *statistically consistent with probability p* if for each event i there are p-quantile estimates of events time $W_p(T_i)$ satisfying the following inequations:

$$W_p(T_j) - W_p(T_i) \geq W_p(\psi_{ij}), \qquad (20)$$

$$I_i \leq W_p(T_i) \leq L_i. \qquad (21)$$

Correlations (20)-(21) are probabilistic analogues of (1)-(2) here, and $W_p(\psi_{ij})$ is a p-quantile estimate of the length of arc (i,j).

Theorem 4. For a cyclic alternative model to be statistically consistent with probability p it is necessary and sufficient that p-quantile estimates of the lengths of all the determinate loops satisfy correlation $W_p(L(K(i))) \leq 0$

Theorem 4. For a cyclic alternative model to be statistically consistent with probability p it is necessary and sufficient that p-quantile estimates of the lengths of all the determinate loops satisfy correlation $W_p(L(K(i))) \leq 0$

Proof.

After calculating the p-quantile estimates the probabilistic model turns into a generalised network model, and the statement of theorem 4 is valid for it (Voropayev, 1975).

The existence of alternative nodes (with possible existence of stochastic loops) does not result in the inconsistency of the network according to lemma 1. The theorem, therefore, holds true for any CANM.

5. CANM TIME PARAMETERS CALCULATION ALGORITHMS

5.1.Early and late time plans

We suggest the modified algorithm of the "Pendulum" (Voropayev, 1975) for calculating early and late event times. The idea of the modification is to create a synthesis of the statistic method of calculating parameters applied for probabilistic networks (Golenko, 1969) and the algorithm of the "Pendulum" used in generalized networks (Voropayev, 1975; Voropayev et al., 1986; Voropayev et al, 1990) and to further apply it for CANMs (Fig. 4):
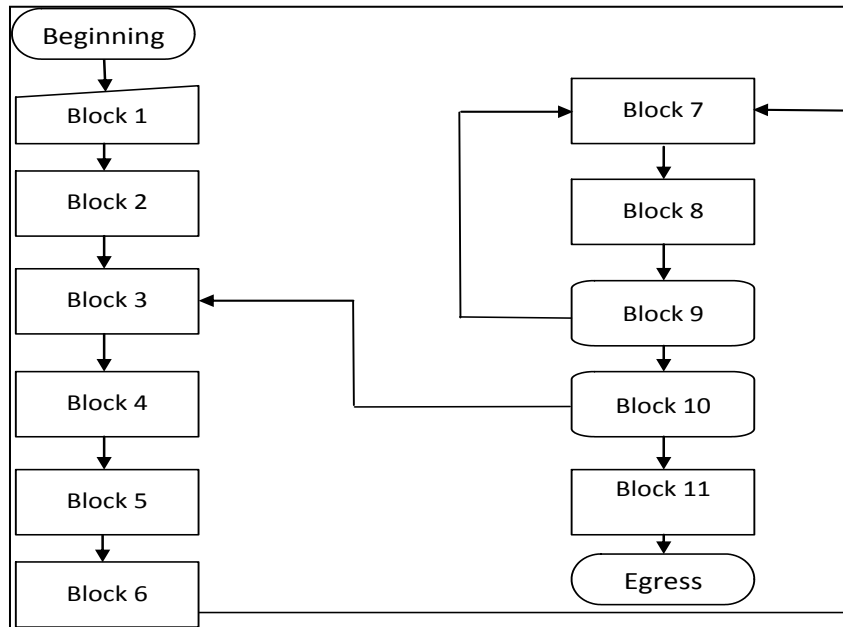

Figure 4. Principle block diagram for calculating p-quantile estimates of early events time

Block 1. Data input (matrix A coefficients, distribution parameters ψ_{ij}, confidence level). Network ordering. For small networks – calculations of P(j) according to GERT-transformation formulas and (13).

Block 2. Calculation of the required number of "drawings" N to ensure the given accuracy of results. The calculation made shows that for p=0.95 and ε≈0.05 we get N≈270.

Block 3. v:=v+1 (v – number of "drawings").

Block 4. The drawing of v variant of random variables ψ_{ij} – each in accordance with its law of distribution – obtaining constants $\psi_{ij}^{(v)}$ – the length of arc (i,j) for drawing v.

Block 5. The drawing of each alternative node i of going to the adjacent node j (discrete random variable p_{ij} represented by the line i of adjacent matrix A, $0< p_{ij} <1$ and $\sum_j p_{ij}=1$). The selected arc is marked and the others excluded from the graph. If in the resulting graph there appeared a loop K(i) containing at least one marked arc, it is a stochastic loop. Then we calculate its length $L^{(v)}K(i)$ and draw a discrete variable P_{ij} again for the node i. In accordance with lemma 1 one and the same stochastic loop for the given confidence level p can appear no more than k times where K is estimated with the formula (14). The k-fold length of the loop is added to the length of the arc that was "drawn" at step (k+1) and goes over to the analysis of the other stochastic loop (if there is one). In this process some inconsistencies (positive determinate loops) can appear in the network, then in accordance with (17) we add the δ-fold length on the loop, thus, estimating the time of the "leaving" event on average.

Block 6. The generalized determinate network $G^{(v)}$ we have obtained is divided into two networks $G_1^{(v)}$ and $G_2^{(v)}$ in such a way that neither $G_1^{(v)}$ nor $G_2^{(v)}$ contains any loops. The nodes of the network $G_1^{(v)}$ are ordered by ranks in accordance with which the right numbering is set. Then this numbering is carried over to the network $G_2^{(v)}$ and the initial $G^{(v)}$.

Block 7. For all the nodes i of the network $G_1^{(v)}$ we calculate the early time of

$T_i^{0(v)}:\max_j\{T_i^{0(v)}, T_j^{0(v)} + \psi_{ij}^{(v)}\}$.

Block 8. Then we do a sequence of manipulations similar to block 7 for the nodes of the network $G_2^{(v)}$.

Block 9. If the results of blocks 7 and 8 do not coincide in at least one parameter we go back to block 7 (the number of these returns is not larger than the number of reverse arcs in $G_2^{(v)}$, otherwise – to block 10.

Block 10. If the number of the drawing v<N, we go over to block 3, otherwise – to block 11.

Block 11. For each node i we calculate the number of its occurrences N(i). For determinate nodes N(i)=N, of course. P(i)=N(i)/N is a statistical characteristic of the probability of the event i occurrence obtained by the method of simulation modeling. From the resulting population $\{T_i^{0(v)}\}$ for each node i we build up a variation series. Fix such a value of $T_i^{0(\zeta)}$ that $N_\zeta/N(i)=p$ where N_ζ is the number of terms of the variation series smaller than $T_i^{0(\zeta)}$. The value of $T_i^{0(\zeta)}$ is the sought-for quantile of the early time of the event i - $W_p(T_i^0)$. In the same way we build p-quantile estimates of the arcs lengths $W_p(\psi_{ij})$ for variation series $\{\psi_{ij}^{(v)}\}$.

The variant v of the generalized network model $G^{(v)}$ comes to the entrance of block 6 and, as a matter of fact, blocks 6 – 9 are a consolidated block diagram of the "Pendulum" algorithm for the calculation of early event times in generalized network models. This algorithm is described in [3,4] in detail as well as the algorithm for calculating the late event time. Applying this algorithm in blocks 7 and 8 we get $T_i^{1(v)}$ – late events time for the v-th variant of the generalized network model. Block 11 gives us $W_p(T_i^1)$ – p-quantile estimates of the late events time.

5.2.Minimum duration plans

The duration of $L(T^{(v)})$ of any consistent $T^{(v)}=\{T_i^{(v)}\}$ of the variant v of network $G^{(v)}$ is defined by the formula:

$$L(T^{(v)})=\max_{ij}|T_i^{(v)} - T_j^{(v)}|. \qquad (21)$$

Replacing blocks 6 – 9 for the block of the test for a minimum of function (21) in the block diagram in Figure 4 we get the minimum duration plan for network $G^{(v)}$ (or a "compressed" plan). Value

$$L(T^{*(v)}) = \min \max_{ij} |T_i^{(v)} - T_j^{(v)}| \qquad (22)$$

is the critical time of network $G^{(v)}$. A method of finding a compressed plan for a generalized network model is described in detail in [4] as well as the algorithms for building up four different kinds of compressed plans:

- early and late compressed plans for an early completion of the project;

- early and late compressed plans for a late completion of the project.

Using the method of finding a compressed plan for a generalized network model and getting the plans obtained as a result through block 11 we get the p-quantile estimates of the compressed plans.

5.3. Calculation of reserve, activity tightness coefficients, P-quantile estimates have critical, reserve and intermediate zones

Time floats for the activity (i,j) correspond here to their p-quantile analogues calculated by the formulas:

$R_p^n(i,j) = W_p(T_j^n) - W_p(T_i^p) - W_p(\psi_{ij})$ for a full reserve, $\qquad (23)$

$R_p^c(i,j) = W_p(T_j^p) - W_p(T_i^p) - W_p(\psi_{ij})$ for a free reserve. $\qquad (24)$

P-quantile coefficients of activity tightness are calculated by the following formula

:

$W_p(k_H(i,j)) = 1 - R_p^n(i,j)/ W_p(T_n^0) - W_p(T_{кр}(i,j)))$, $\qquad (25)$

where $W_p(T_n^0)$ is the p-quantile estimate of the critical project implementation time, $W_p(T_{кр}(i,j))$ is the p-quantile estimate of the duration of the coinciding with the critical path maximum path interval containing the activity (i,j). $0 \leq W_p(k_H(i,j)) \leq 1$, moreover, the closer $W_p(k_H(i,j))$ is to 1, the relatively less time float the activity (i,j) has, the higher is, therefore, the risk of the failure to meet the set date of this activity.

Then the p-quantile critical zone, the p-quantile zone of reserves and the p-quantile intermediate zone (Golenko, 1969) are determined:

- the p-quantile *critical zone* contains activities with $Wp\{K_{ij}^H\} > p_1$ where the value of p_1 is close to 1 $(p_1 \approx 0.8 \div 0.9)$;

- the p-quantile *zone of reserves* comprises activities with values $Wp\{K_{ij}^H\} < p_2$, where p_2 is close to 0 $(p_2 \approx 0.2)$;

- the p-quantile *intermediate zone* $p_2 \leq Wp\{K_{ij}^H\} \leq p_1$.

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PROJECT MANAGEMENT AND QUALITY ASPECTS – PRINCIPLES AND PRACTICAL EXPERIENCES

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Abstract: Quality and Project Management represent two different disciplines, developed independently, but closely related. A successful implementation of a project i.e., its completion within planned time and resources, as well as the delivery of products with required quality, demands a systematic approach to planning and implementation, in which a very important role belongs to quality management, independently of the project phase. To enable the quality of products it is necessary to take necessary actions in advance, during the project planning and implementation, not only at the very end. This concept is known as "quality assurance". This paper discusses the principles and practical aspects of quality assurance application within the project lifecycle, from bidding and contracting and project establishment up to closing out of the project, illustrated by an example of a particular company.

Key words: Project Management, Quality, Quality Assurance, Quality Management System

1. INTRODUCTION

Quality and Project Management represent closely related disciplines, although they have been developed independently. There are several reasons for this attitude.

Firstly, both disciplines are based on business processes defining and organizing.

Secondly, Quality Management System (QMS) established in an organization is visible in the best way just through Project Management (PM) activities.

Thirdly, the QMS represents a valuable support to project implementation within the organization.

And finally, the quality of products (goods, software, services) is strongly dependent on the quality of processes they are based on.

company, Energoprojekt-Entel.p.l.c., Belgrade, Serbia (hereinafter: ENTEL). The core business

Quality is defined (ISO, 2005) as "a degree to which a set of inherent characteristics fulfils requirements".

Based on this, Quality Management System – QMS could be defined as "a management system whose main aim is to establish, improve and advance business processes in organization which will enable the product delivered to customers to fulfill their requirements, needs and expectations and to attain their satisfaction" (Raković,2006). To enable the quality of products it is necessary to take actions in advance, during the project lifecycle, not only at the very end. This concept is known as "quality assurance".

This paper discusses aspects of the quality assurance application within the project lifecycle, both from the point of view of principles and of practical experiences, illustrated on the example of the particular

of the company is Engineering Design and Consultancy Services related to Projects in the

fields of Energy, Water, Telecommunications, Environment protection and Project Management. Categories of ENTEL's products are design documentation (studies, tenders and technical documents), provision of consultancy services and occasionally customer's specific software development.

2. QMS AND PM BASIC ELEMENTS

Simplified review of QMS's essence is shown in Figure 1 (Raković, 2007).
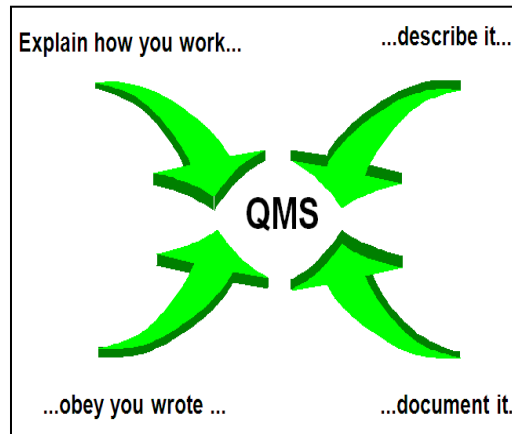
Figure 1. The essence of QMS

The first step requires the organization to explain how it works. It is very important to note that QMS does not deal with the question if this way of work is good or not - nobody forces the organization as to the way it does its business, the way organization defines its business processes is verified on the market, through its survival. In the second step the organization is required to describe its way of work, to make it accessible and visible to others in written form (on paper or other media).

The most important step is the third step – the organization is required to obey the rules it defined itself. This is the most critical step in practice – organization can find a consultant which will prepare documents, but carrying out the system is its own obligation, nobody can do it instead of the organization itself. Finally, it is very important for the organization to provide evidence that QMS is in function with the help

of the records that document the performing of QMS.

On the other hand, the project is possible to define (Jovanović,2006; Raković ,2007) as "a complex and unique business endeavour undertaken in the future to achieve an objective conforming to specific requirements, within expected time and within planned resources and costs". From this definition it is clear that a project is carried out in conditions of several constraints related to time, resources and costs that make it difficult to achieve the objective(s). To implement the project successfully under these conditions, a particular dicipline is developed, known as Project Management. The essence of the PM concept is shown in Figure 2 (Raković ,2007) – we are planning, monitoring and controlling time, resources and costs to achive project's objective(s).
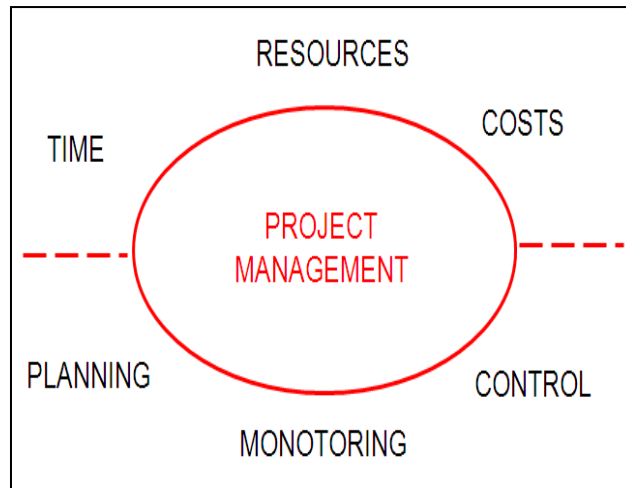
Figure 2. Illustration of PM concept

The upper section of the figure shows elements related to constraints, and the lower one shows the methods to overcome these constraints. *Time* is an ever important element, sometimes decisive for project success (if a sports hall is not finished in time, before the start of a competition, no optimization of costs or resources have importance). *Resource* is a common name for people participants in project and material assets used within the project, that should be available when it is necessary from the point of view of project needs. *Costs* are expressed in money and they are always limited, i.e. a certain budget is defined in advance. To implement the project successfully, activities should be planned, the project execution should be monitored and some

preventive and/or corrective actions should be taken to eliminate or mitigate the consequences of potential negative impacts upon the project objective(s) achievement.

A project as business endeavor consists of several phases and activities that engage significant resources – human, material and financing. Because of its similarity with the human life, from birth to death, it is usually described using the concept of „Lifecycle“, shown in Figure 3 (Jovanović ,2006). This concept makes it possible to break down long and complex projects into smaller, more understandable and manageable parts. Figure 3 shows global phases of a project – initiating, planning, implementation (including monitoring and reporting) and close out.
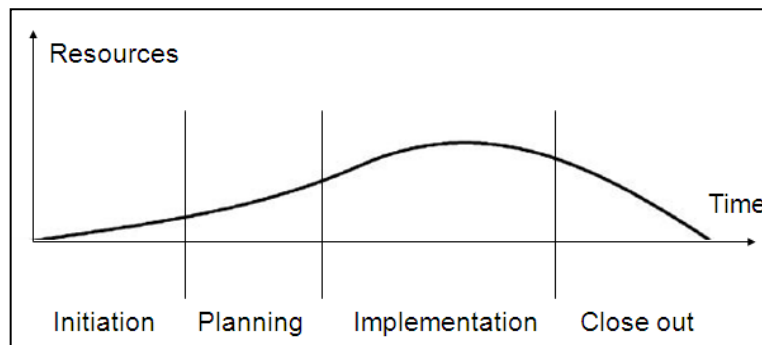
Figure 3. Project lifecycle

Of course, this project lifecycle is preceded by the phase of bidding and contracting, that leads to the project being awarded. Hovever, this phase is sometimes tretaed as a separate project with similar phases because it is usually implemented by separate part of the organization (for example, marketing). In this paper, since the emphasis is upon quality aspects, this phase will be treared as a constituent part of the initiation phase.

3. QUALITY IN PROJECT ENVIRONMENT

From the definition of project it is clear that project implementation is a very demanding task – it is necessary to meet the requirements, needs and expectations of customers and other stakeholders (management, employees, stockholders, suppliers, financial institutions, social community) that are sometimes opposed to one another; activities are performed in the future, in conditions of uncertainty and risks; the constraints reduce number of alternatives etc. In addition, a successful implementation of the project is limited by the fact that several other projects are implemented in parallel with it within the organization and more or less have an impact (unfortunately, usually negative) upon the project. Figure 4 shows a model of project implementation environment (Raković,2007).
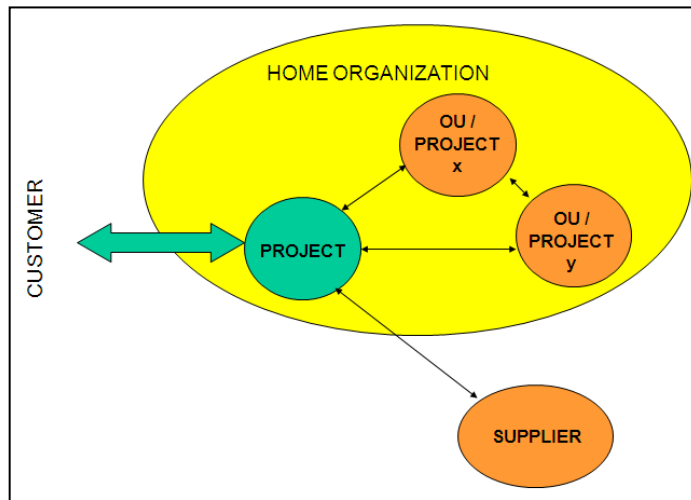
Figure 4. Project implementation environment

This model is based on a visual interpretation of the ISO 10006:2003 guidelines devoted to quality management in projects (ISO,2003), with some terminology changes to allow for a better understanding in practical conditions ("home organization" and "project" instead of "originating organization" and "project organization", respectively). As per Figure 4, a project is considered to be temporary organizational unit (OU) within the home organization coupled with other organizational units within and out of it – customer, supplier etc. This model is better harmonized with the concept and requirements of QMS given within the ISO 9001:2008 (ISO 2008) standard and allows for a better perception of participants'

roles within and around the project.

To percieve the role of quality in projects, it is necessary to take into account eight principles of QMS defined within the standard (ISO,2005). The essence of these principles are as follows (Raković,2007):

♦ *Customer focus*: Organizations depend on their customers and their obligation is to meet the customers' requirements, to understand the current and future customers' needs and to try to exceed customers' expectations. The customer satisfaction, as a dominant stakeholder, is the main objective of all activities within the organization, as well as within a project.

70

♦ *Leadership:* The most important role of leaders is to establish a unity of purpose and direction of an orgnaization or a project. From this point of view, the leader's devotion to quality has a crucial importance in establishing, maintaining and improvement of QMS.

♦ *Involvement of people:* People at all levels are the essence of an organization independently of nature of its core business activities. Accordingly, people represent an active factor in the establishing and implementation of QMS in the organization and within a project, and their initiatives can significantly contribute to QMS improvement.

♦ *Process approach:* A desired result is achieved more efficiently when activities and related resources are managed as a process. From this point of view, an organization as a whole is viewed as a group of mutually coupled processes, both in product realization and in supporting ones.

♦ *System approach to management:* Managing interrelated management systems in organization or within a project as a system (quality, financing, environmental, occupational, health and safety management etc) contributes to the organization's effeciveness and efficiency in achieving its objectives. It is similar to an orchestra - particular group of instrument are necessary to be synchronized into harmonized entities, otherwise no acceptable result will follow and people will leave the concert hall!

♦ *Continual improvement:* It is considered to be the essence of the quality management systems! Methodology PDCA („Plan-Do-Check-Act") is applied, as a permanent objective both in organization and within a project.

♦ *Factual approach to decision making*: All decisions are necessary to be based on the facts related to problem, resulting form the data and information analysis, instead of from a "rule of thumb". Information

systems play a very important role in this approach.

♦ *Mutually beneficial supplier relationships*: It is necessary to establish a long-term mutual co-operation with supliers based on partnership rather than a usual "buying and selling" relationship. It allows for both sides to create value and improve their own performance.

Quality management in projects is performed through two processes – quality assurance and quality control.

Quality Assurance (QA) is "focused on providing confidence that quality requirements will be fulfilled" (ISO,2005). This process consists of preventive actions oriented to establish conditions within the organization, as well as within a project to achieve the quality of products to be delivered, through quality of processes from which these products arise. This is usually achieved by establishing, maintaining, improving and advancing the quality management system within the home organization and its cerification as per the ISO 9001 standard. Quality assurance within the home organization is closely related to the responsibility of top management and it is manifested through the following activities (Raković,2007):

♦ Communicating to the organization related to the importance of meeting requirements, needs and expectations of both customer and all stakeholders, as well as meeting the law and regulatory requirements.

♦ Establishing the Quality Policy.

♦ Ensuring that quality objectives are established, both at the global level of an organization and in particular projects.

♦ Ensuring that planning documents are prepared for project realization.

♦ Conducting management reviews related to quality assurance activities.

♦ Ensuring the availability of resources.

♦ Establishing organizational pre-conditions for quality assurance (particular

organizational unit devoted to this topic, the person responsible, ...).

The role of quality assurance throughout the project lifecycle is shown in Figure 5 (Raković,2007), as an umbrella that protectsthe project from impacts arising from the environment that can have negative consequences to project objective(s) achieving. The details related to quality assurance per particular phases within the project lifecycle are discussed within the next chapter. Particularly important in Quality Assurance within a project

is the management review at the home organization level. The management review is an obligation as per item 5.6 of the ISO 9001 (ISO, 2008) standard, it covers all elements monitored within the organization (including those related to projects); the participants in this process are, at the same time, most responsible for QMS functioning and plans for improvements are established within this process, including the manner in which it will be conducted.
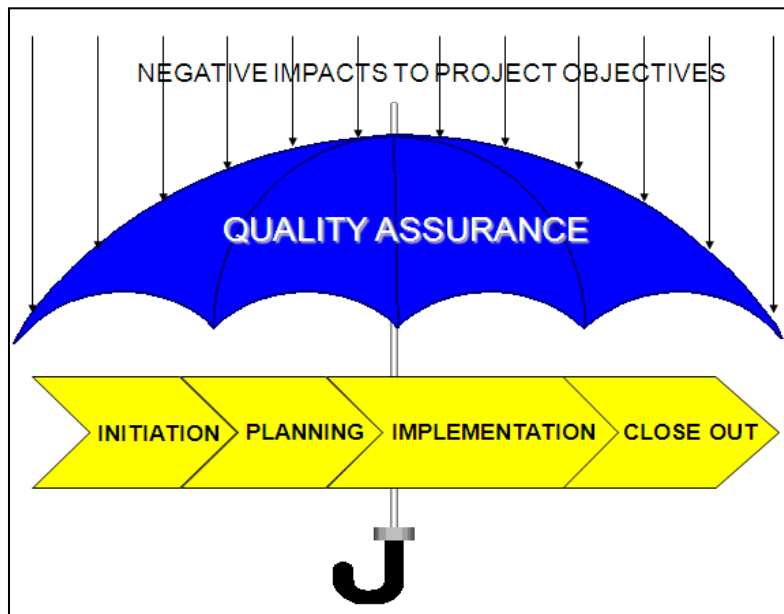
Figure 5. Role of Quality Assurance in project lifecycle

Quality Control (QC) is "focused on fulfilling quality requirements" (ISO,2005). This process is oriented predominantly to technical aspects related to planning, implementation and monitoring the quality in projects, the measurement of quality characteristics, performing of corrective actions in case when there is a deviation from the defined quality characteristics.

Nowdays, QC is not a simple statement of problems at the end of process (known as "counting of the dead") but an instrument for the implementation of the principles of Quality Assurance.

4. PROJECT LIFECYCLE PHASES AND QUALITY

4.1 Initiation

This phase covers bidding and contracting as well as the start up of a project.

Bidding and contracting includes a large number of activities such as market investigation, presentation of products including pre-qualification documents, bid preparation, contract signing etc. The most important activity within this phase, from the point of view of quality, is to recognize all customer requirements, their real needs and expectations, to avoid any missunderstandings

or disputes in the future. Although the customer initiates the project, he is usually not an expert in the subject area and does not know exactly what is necessary to be done in the project implementation. It means that our obligation is to help him understand his real needs and better define the requirements.

This approach is useful for several reasons – to avoid problems and negative consequences in project implementation and achieve customer satisfaction before the beginning of the project, because the customer rests assured that the organization is committed to this project and takes care of its objectives. At the same time, the organization improves its reputation, which is very important for future activities on the market.

After defining the requirements, the organization has an obligation to review them from the point of view of its own ability to meet them, Item 7.2.2 (ISO,2008). This review shall be conducted prior to organization's acceptance of obligation i.e. signing a contract. If the organization is not sure as to its ability to meet the requirements, it had better give up the contract than accept to do something that is questionable – the damage suffered will be smaller.

After the contract has been signed, it is necessary to start with its implementation. The major pre-condition is to establish the project as organizational unit within the home organization. The methodology of the Project Management Institute – PMI (PMI,2008) defines this document as a "project charter".

In practice, it is usually done by issuing a document related to the project establishment. In case of ENTEL's QMS (ENTEL,2001-10) there is the form „Decision on Project Establishment". A project is established based on a signed contract, letter of intent or any other document with contract power, or particular decision of the management or the Board of Directors.

The importance of a formal project establishment is much bigger in practice than it appears to be. All stakeholders are officially informwd that the project starts, the major participants in the project implementation and

their roles are identified, the person responsible for the project plan preparation is appointed, the organization of the project is established, some contraints are defined (if any), etc.

With this phase, the conditions are established that project as temoprary but particular organizational unit should take place within the home organization, in the environment such as one presented in Figure 4. This phase usually does not take long, but sometimes can be decisive for the success of the project.

4.2 Planning

There is a sentence that a "good plan means a half of job done". Maybe this statement is pretentious, but there is no doubt that planning is the most important phase in any project. This phase is implemented by preparation of the basic planning document related to the project (known as "baseline"), covering activities to be performed, time schedule, resources (human, material, financing) to be engaged, products to be delivered, particular costs, responsibilities of participants, quality assurance activities to be performed etc.

Within ENTEL's QMS (ENTEL,2001-10), the central planning document is the "Techno-economic Program for project realization" (TEP). The TEP represents both the basic planning document ("baseline") and the document for design and development planning of new and/or modification of an already developed product. This document is prepared for each project just after the project establishment to determine the key elements for its implementation (activities, time schedule, human and material resources needed, quality plan, responsible persons etc). the TEP includes the scope – WBS (Work Breakdown Structure), the project objectives, the organization for project management, the time schedule, human and material resources and costs allocation, the quality assurance plan (if not prepared as separate document), the responsibility matrix etc. The TEP is analysed and adopted by the Expert council of ENTEL.

The project quality plan is a document that identifies the activities and resources necessary for achieving the quality objectives of the

project. This document should be incorporated into, or referenced in, the Project Management Plan. The Project Quality Plan covers the plan of control activities including some check points in which the control and work activities should be harmonized.

There are several important things to be pointed out, based on ENTEL's experience:

♦ The quality inspection should be preformed during project realization, not only at the very end, planned at a monthly level, depending on the phase of the project.

♦ The Project Quality Manager (PQM) function should be established to prepare Project Quality Plan in coordination with the Project Manager, to coordinate with customer represenatives related to quality, to coordinate quality inspection activities within the project etc.

♦ If necessary, the Expert Council should be appointed during the project course, to direct further activities.

♦ Control (check) points should be foreseen, to review project activities, give guidelines or take corrective actions.

♦ The method of product quality verification should be established, including parts or products prepared by a supplier, that have impact upon the quality of product delivered by ENTEL (control of "outsource" process).

♦ The Expert Council for final product assessment should be organized in time, prior to the final schedule for product delivery to customer.

♦ Organizational pre-conditions for quality assurance (particular organizational unit devoted to quality, responsible person, ..) should be established.

The ISO 9001 (ISO,2008) standard, Item 7.3, provides three forms of design and development evaluation – review, verification and validation. *Review* (Item 7.3.4) evaluates the ability of the products to meet requirements and identifies any problems and proposes the necessary actions. It is performed during the product realization. *Verification* (Item 7.3.5) assesses whether the products meet the input requirements i.e. whether the results are in compliance with contract clauses. It is carried out before a product delivery. *Validation* (Item 7.3.6) states if the products meet the requirements for the specified application or intended use, where known. This activity is often done in cooperation with the customer, after a product delivery.

Within the ENTEL's QMS (ENTEL,2001-10) these forms are implemented, as follows:

♦ Review is implemented by Quality Inspection (QI) Engineers with particular specialties. Their activities are coordinated by the Project Quality Manager.

♦ Verification is implemented by the Expert Council with three main roles – adoption of TEPs, directing project activities (according to need, as per project manager proposal) and final assessment and product delivery approval.

♦ Validation is implemented in cooperation with customers (external design assessment for final design, assessment of basic design by inspection team within authorized ministry, consideration of designs within the Expert Council within customer organization).

In project planning it is very important to pay attention to activities related to the use of resources that represent public property (for example frequency spectrum in telecommunications) or issuing technical conditions or licences of authorized state bodies or institutions.

These activities are usually in the "critical path" of the project because they require some time and they do not depend on the organization itself. It is necessary to initiate these activities in time because a particular project is not the only one and the capacities of these bodies or institutions are not boundless (although in practice there are a lot of reasons not to be satisfied with their work).

A constituent part of the basic planning document should be the assessment of project

risks. The project is planned in this moment, as mentioned above, however, it will be implemented in the future. It means that we have to identify uncertainties throughout the project, to assess them (the probability of their occurence and their impact upon the project), to develop plans for responding to risks and to implement these actions.

4.3   *Implementation*

The basic planning document prepared within the previous phase and adopted at the appropriate level within the home organization represents the basis for the project implementation. In the first place, this plan is worked out by preparing operational plans at monthly, weekly or daily levels (depending on the nature of the project) up to the level of the particular performer. This is the first element of the QA in the project – the operational plan announced to each person what is the art of the job he/she is expected to perform and at the end of planning period it represents the basis for the assessment of their contribution and the main element for monitoring and reporting related to the project progress.

In ENTEL's case (ENTEL,2001-10), after the TEP adoption by the Expert Council, the project realization starts by operational planning, engagement of planned resources and reporting. At the beginning of a month, each employee receives a filled-in form "Order to work – Activity log" with tasks he/she will be engaged in within the month, and in which activities during the month will be recorded. If there are any difficulties during the project implementation, it is possible to organize the "directing" Expert council to help both project manager and project team to overcome these difficulties and implement the project successfully.

During the project implementation, a technical review is performed continually by QI engineers per specialties, in coordination with the PQM. After preparation, the product is verified at the Expert council before its delivery to the customer. Projects usually engage different specialties (architecture, civil, mechanical, electrical, telecommunication) and project managers should coordinate them to

enable a successful completion of these projects.

A constituent part of the project implementation are also the monitoring and reporting of the project progress. At the same time, they represent the essence of quality in projects – provision of "written traces" as a form of evidence that the system is in function (see Figure 1, step 4).

Monitoring and reporting are based on collectiong information from the processes and its presenatation to all stakeholders in the form undarstandable to them and expressing their interests. In practice, reporting is often treated as unnecessary "red tape". Hovever, reporting has one very important consequence – if realistic, it allows for any problem to be noticed in time and necessary corrective actions to be taken to return the project into the planned frameworks. If the problem is detected too late, when all deadlines have passed and the budget is spent, the consequences of these problems can be disastrous for the project objective achievement.

4.4   *Close out*

The project itself is a process and special attention should be paid to its closure. In most cases, the project is closed when its objectives are achieved. However, in certain cases it may be necessary to close the project earlier or later than planned, due to unpredicted events. Whatever the reason for project closure, a complete review of project performance should be undertaken. It is very important to realize that project closing is not a moment, it is a proces consisting of several activities (Raković,2007):

♦   Apropriate reports should be prepared, with elements related to resources (human and material) spent, costs, time schedule and products delivered, with clear assessment of project objectives achievement, as per previously defined criteria.

♦   A completion certificate should be prepared as an evidence that the organization was engaged at this project and that the project is succssfully

completed. This document is very important for the future bidding and contracting activities.

♦ The final delivered version of the product (if applicable) should be archieved to enable its use in the future for any reasons. In case of the design documentation it means keeping the text and drawings in the form of text processor and software for drawing preparation (for example MS Word or AutoCAD). In case of the software it is necessary to keep the source code and the appropriate documentation (descriptions, instructions for the user or the maintenace personnel), and in case of building it is necessary to keep the As-Built documentation, etc.

♦ Some conclusions as experience form the project should be made, as some kind of "lessons learned" for future projects. Good practice should be followed in the future, mistakes should be avoided. If possible, it is better to learn from mistakes of others, but the effect of own experience is a more important "weigting factor" and it is something that is irreplaceable.

♦ All the relevant records related to the project are to be systematysed (arranged) in paper or in another form. Nothing important for history of the project should be left to the participants to keep "in mind".

♦ Major information to marketing related to the project should be provided. This project is an important element of the home organization reference for the future marketing activities.

♦ Major results of the project should be published. At the same time, this is an affirmation of an expert's accomplishments and signal to potential customers that the organization has capabilities and experience to meet their needs and requirements.

♦ Celebrate if you have a reason for it.

5. CASE STUDY: ENTEL

The major business of ENTEL is, as mentioned, Engineering Design and Consultancy Services and the categories of ENTEL's products are design documentation (studies, tenders and technical documents), provision of consultancy services and occasionally customer's specific software development. The QMS in ENTEL was established in December 2001, certified by Lloyd's Register Quality Assurance (LRQA), and recertified by the same certification body three times, in December 2004, 2007 and 2010. Within the first certification three-year period, the project of the QMS re-engineering had been implemented based on the project principle and "breakthrough" with its own power i.e. without engaging any consultant company, thanks to the personnel structure of the company(Raković,2006). In the middle of the 2009, establishing the Integrated Management System (IMS) was started by establishing Environmental Management System, as per ISO 14001:2004 standard. Further improvement of the IMS continued at the end of 2010, by establishing of the Occupational Health and Safety Management System, as per BS OHSAS 18001:2007 and the Energy Management System, as per the EN 16001:2009 standard. In the near future, the company plans to establish the Information Security Management System as per the ISO 27001:2005 standard.

As mentioned above, the central document of the ENTEL's IMS is the Techno-economic Program for project realization (TEP) that represents the project baseline. This document is prepared for each project just after the project establishment to determine the key elements for its implementation (activities, time schedule, human and material resources needed, quality plan, responsible persons etc). A project is established based on a signed contract, letter of intent or any other document with contract power, or particular decision of management or the Board of Directors. The TEP is analysed and adopted by the Expert council of ENTEL.

After the TEP adoption, the project realization starts by the engagement of planned resources and operational planning and reporting. If there

are any difficulties during the project implementation, it is possible to organize the "directing" Expert council to help both project manager and project team to overcome these difficulties and implement the project successfully. During the project implementation, a technical review is performed continually by Quality Inspection (QI) engineers per specialties, in coordination with the Project Quality Manager (PQM). Depending on the project complexity, the PQM is a particular person, or this activity is performed by chief engineer or head of the project-leading department. After preparation, the product is verified at the Expert council before its delivery to the customer.

In process of product realization, the following Key Performance Indicators – KPI's are monitored (ENTEL,2001-10):

♦ Spent and planned resources (K_1):

Represent the ratio of resources (for example man-months) spent during the project realization reported within the completed project report and resources planned and approved in the TEP. The number of resources spent includes resources spent up to the delivery of the product as well as resources spent for corrections of the product after validation. The main aim is this ration to be $K_1<1$;

♦ Resources spent after validation (K_2):

Ratio of resources spent for corrections after the validation and resources spent for the design preparation. Represents the ratio of the resources spent for correction of the already delivered product after validation and the total number of resources spent for the product realization. The resources spent for correction after validation are related to the ones spent for corrections as per accepted comments of the Customer Expert Council or Revision committee of the authorized Ministry. These spent resources, recalculated to the money, represent the cost of "non-quality". Of course, we are taking into account only

the comments which are within the scope of the Terms of Reference (ToR) - additional requirements are covered by annexes of the contract. The value of this parameter is set to the value of 1,5% and is subject to continual monitoring and review;

♦ Designs without comments during verification (K_3):

Represents the ratio of the number of designs without comments during the verification before the delivery and the total number of designs prepared. As per ENTEL IMS, each product is reviewed by QI engineer during preparation and the verification is performed by the IMS department and the Expert Council that approves its delivery. This parameter enables the IMS department to monitor activities and work of QI engineers - as a matter of fact, they are the "join members" of the IMS department, although they are officially working within technical departments. At the beginning, this parameter was declared to be $K_3>30\%$, and since 2005 it has been set to be $K_3>40\%$;

♦ Average number of comments per total number of designs with comments (K_4)

In the beginning, it was declared to be $K_4<3$, since 2005, it has been set to be $K_4<2,5$.

The first two parameters are used to monitor and measure performances of processes, the other two illustrate the conformity of products. This set of KPIs was broadened in 2005 with additional KPI from financial parameters. This indicator K_5 represents the participation of costs for competence improvement within the total income, and it has been set to value $K_5>0,5\%$.

Within ENTEL's IMS (ENTEL,2001-10) there are two forms that are necessary to be filled-in at the end of the project – "Preliminary / Final finished project report" and "Order to complete the project". The first one includes the confirmation of the Head of IMS department that the CD with final version of documentation is provided, and the second requires to provide

completion certificate from customer. On signing this order by the authorized manager, no additional activities or costs related to this project are possible.

Reports per particular projects are summarized within the Management Review Report prepared annualy. Figure 6 shows the PARETO analysis of non-conformities per types, as follows:

A   - Deviation from instruction for Technical documents – general part

B   - Deviation from instructions for appropriate Technical documents

C   - Deviation from instructions for Technical Documents preparation

D   - Design non-completeness

E   - Other nonconformities
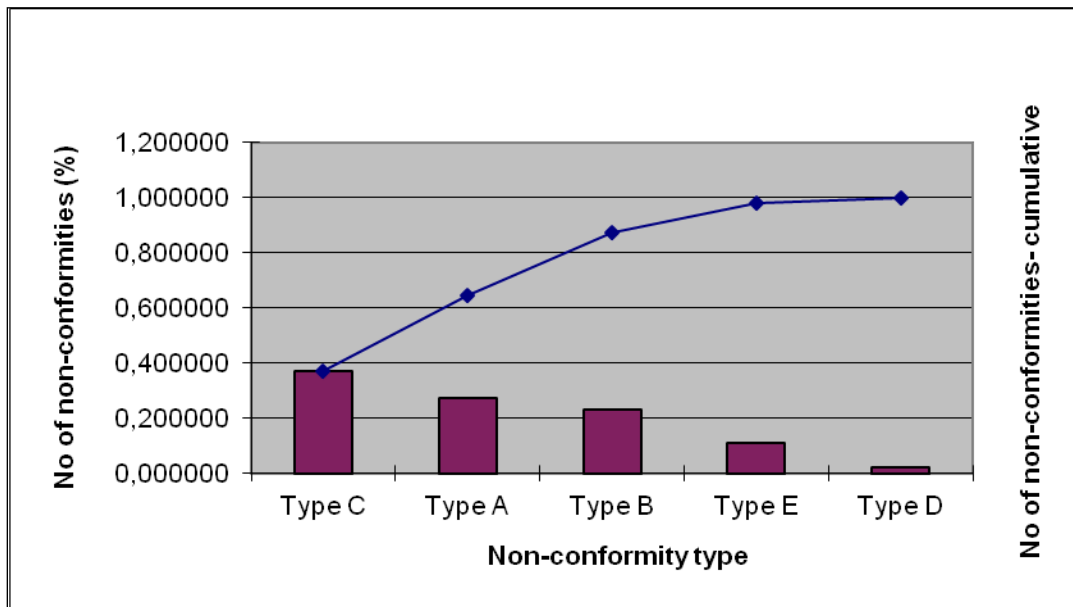
Figure 6. PARETO Analysis of non-conformities in 2010 (ENTEL 2001-10)

6. QUALITY IN PROJECTS-MISLEADS AND PREJUDICES

In this chapter, several the most often misleads and prejudices related to quality in projects are presented, per project phases.

Initiation

♦   "We know better than the customer what he needs?!" it was already mentioned in Chapter 3 that organizations depend on their customers and therefore should understand current and future customers' needs, meet their requirements and exceed customer expectations. The main idea is to help customers express their real needs and make best efforts to meet them. Organizations exist because of customers, not conversely!

♦   "It is most important to get the job, later we will handle it as we know?!" Fully understanding that it is necessary to provide full employment, these situations are too dangerous and should be avoided. Sometimes it is better to give up the job than to endanger the organization's survival with contracts under suspicious conditions.

Planning

♦   "This project is too short to be the subject of planning?!"

♦ "This project is similar to the previous one, there is no need to plan it?!"

♦ "Let us work, we don't have time to prepare these formal papers?!"

The common idea of these attitudes is to find reasons not to plan the project! This is typical of "problem oriented management" – to allow people to work without any organization, and in case of (certain) problems to take the role of "rescuer", to show that nothing can possibly be done without them.

The consequences of such an approach are long-term and disastrous – instead of the establishment of defined processes, maximal improvisation is imposed in which all outcomes are equally probable, and after the (certain) failure a culprit will be found!

Implementation

♦ "We are late with this project, we will resolve it by overtime work?!"

♦ "We are late with this project, we will add new people?!"

♦ "We are late with this project, but we will compensate it by the quality of product delivered?!"

Overtime work is one of possible solutions, but with short-term effects. Adding new people often causes more delay in the project, because it is necessary to engage members of project team to help to new-engaged ones. In addition, when signing a contract, one accepts to do the job with some level of quality and no delay should compensate for it. Budget (resources), time schedule and quality are crucial elements of the contract obligation, it is necessary to establish some kind of a balance, and no exchange is possible.

The most common problem related to monitoring and reporting is the absence of reports or their inadequate preparation. In such a case, it is not possible to make adequate decisions related to the current project and many valuable information is lost for future projects.

Close out

Organizations often do not keep final reviews of delivered products (if applicable), because project managers "do not have time to deal with it". This approach endangers the future activities of the organization, because the accumulated experience is lost and not available to people in the current organization's activities.

Project Manager Role

In practice, there is a lot of misunderstanding related to the real role of the project manager. People usually connect its role to expert knowledge in the area the project is related to. But, it is necessary to have in mind that the major task of a project manager, together with the project management team, is to manage the project to enable achieving project objective(s). To do it successfuly (Jovanović,2006; Raković ,2007), the project manager should have certain knowledge (about project management and technology, but not only from his field of expertise but also from several other diciplines), to own some capabilities (organizational, communication) and some personal traits (stability, enthusiasm, ambition, energy, honesty etc.).

The knowledge is possible to collect through education process, capabilities exist but they are necessary to be developed, traits are embedded into our personality, and it is very difficult to cahnge anything. From this consideration it is clear that the most acceptable way of project manager development in practice is to make an initial selection of people based on their faetures and readiness to do this kind of job, to educate them both from the point of view of project management skills and that of technology knowledge, depending on the core business of the organization and to develop their capabilities through particular tasks during their work obligations, from routine to the most complex projects. Of course, this process is long-term and demands organized approach, efforts, investments, patiency etc., but provides very good results.

Nowdays, project management attain a level of particular profession, fully recognizable both in Europe and all over the world.

7. CONCLUSION

In this paper we summarized some aspects of quality assurance in projects and illustrated them through practical experience. It is very important to understand that quality plays a significant role in the project lifecycle and allows for achieving project objectives i.e. completing these projects in time, within the planned resources and costs. There is a saying that "The World is full of capable people, only capable managers are missing to organize them!". The application of quality management principles into project management is one of the possible ways of doing it.

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KEYS TO SUCCESS BY THE PROGRAM OF DEVELOPMENT OF UKRAINIAN PUBLIC FINANCE SYSTEM

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Abstract: The necessity of the success management in the reformation of complicated systems, especially the public finance system of Ukraine is discussed in the article. The authors suggest seven keys of success which make it possible to elaborate the strategy of reforming the domestic public finance system.

Key words: public finance system, the keys of success, reforming, implementation, the budgetary policy paradigm.

1. INTRODUCTION

Since the development and implementation of the "Reload of the public finance system of Ukraine" program, the authors understood that it is necessary to solve a number of problems that have accumulated over the years of independence. On determining the mission of public finance reforms, it was decided that public finance should become an engine of social and economic reforms conducted in Ukraine.

In the process of conducting the cardinal reforms in the field of public finance, the authors faced a number of issues:

1. Is it possible to carry out such reforms at the height of financial crisis?
2. Are these reforms correctly apprehended and supported by society?
3. How to manage the programs of unpopular reforms?
4. Do reformers always serve as a "kamikaze"?
5. How can reforms be made success oriented and be successful in the course of their execution?

The program was performed after the global financial and economic crisis of 2008-2009.

During its preparation and realization the authors have accumulated a lot of experience in managing such complicated changes of the public finance system in the turbulent surroundings. Precisely, this experience, enriched by the knowledge of project and program management, presents the basis of the approach used in the management of project and program success. During the realization of separate projects and of the entire program the authors tried to determine the formula of success. Such formula was worked out for a fiscal policy as the key instrument of the state budget formation. Having formed the management paradigm, this formula gave an impetus for the reformation of budgetary, tax and customs spheres that form a frame of the public finance system.

The considered program primarily referred to the budgetary, tax and administrative reforms conducted by the government of Ukraine in 2010-2011. To focus on the success of these reforms was a key objective for the country's leadership and the managers of the program (Azarov et al., 2011)

2. METHODOLOGY OF SUCCESS MANAGEMENT IN REFORMING COMPLEX SYSTEMS

What does it mean to be successful in this dynamic and often turbulent world?

The answer to this question is simple and complex at the same time. To be dynamic? Namely, there is a need to be proactive, oriented on value creation, by using the trend of passing to the economy of knowledge, to change the management paradigm in time, to understand the philosophy of life cycles and to reload the system timely, be creative, develop knowledge and perfection centers.

Each of these elements is a key to success, and the formula for success is determined by their interaction. The keys to success of projects and programs of complicated systems reform form the development programs management methodology, defined in the following sections.

Let us consider every key of success and focus on some mechanisms of methodology, which provide a successful reformation of the complicated systems which includes the public finance system of Ukraine (Bushuyev & Bushuyeva, 2010).

3. KEY TO SUCCESSFUL PROGRAM MANAGEMENT

Key 1. Be proactive

3.1. *To have the formalized model of the future*

The Ministry of Finance of Ukraine elaborated and is applying the model of proactive management of public finance development shown on Fig. 1.

This model is constructed by taking into account potential falls in the critical points (points of bifurcation) in public finance development and allows creating a program that takes into account the critical events and concentrates on success (Bushuyev, 2007).

By analyzing the model, we can see in the next two year period the potential crisis of transition to professional management in the course of administrative reforms, of autonomy at the local budgets, of "center - regions" relations and of manageability. All this will result in the loss of trust (critical point 6).

Figure 1 shows an area 2010-2011, where actions have been performed that correspond to critical points of the model given below:

3.2. *To see the future*

When a new project or program starts, usually we face the questions: what is the future, what to expect, how to assess the vision of the future within reach, uncertainty, risks along the way and results? An effective manager must be "visionary" because only a vision of the future product and its implementation can ensure success (Vigueirier et al., 2007; Cleland, 1996)

Fig. 2 shows the vision of fiscal policy in 2012 and formulas for the budget execution success.

Figure.1 Model of proactive program management of public finance development
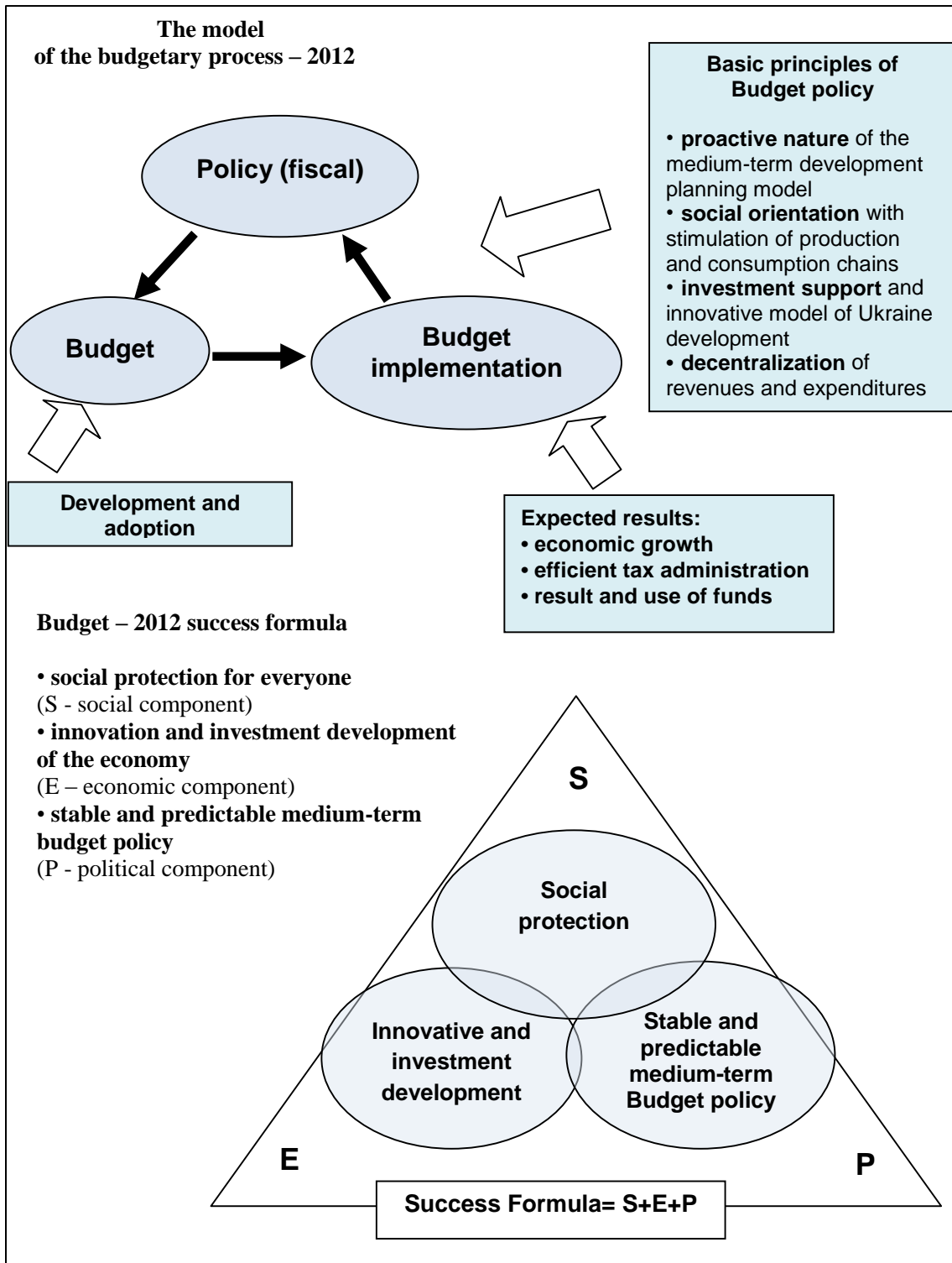
Figure 2. 2012 budgetary policy vision and formulas for budget execution success

Figure 3.Changes of fiscal policy paradigm 2010-2014

The change of public finance fiscal policy paradigms is considered on Fig. 3.

The new government plans to apply three models of fiscal policy: 2010 - economy of patience; 2011 - from economy of patience to stabilization and development; 2012-2014 – driving force of a competitive economy building based on social orientation with production and consumption chains stimulation, on proactive nature of the development medium-term planning model, on the revenues and expenses decentralization, on the support of investment and innovative model of development of Ukraine.

3.3. *To understand and to use the trends*

Management based on trends makes the process proactive. The art and science of trends analyzing is a method that a team uses in the process of the development of management, by generating and analyzing the new ideas or development strategies.

Trends never arise out of nothing and never stop without reason. One of the trends that accompanies the development of Ukraine, is a "demographic hole" created by the decline in fertility during the restructuring and formation of independent Ukraine. The consequences of this trend are the chain reactions in the areas of the real economy, pensions, production staff assistance. It causes negative trends and suspends economic growth. The strategies for responding to this trend include the border opening for labor migration, trend-oriented economic conversion, fertility promotion, etc. (Forsberg et al.,2000).

The authors developed a model of public finance management based on trends. A concentric model of medium-term budget planning trends is shown on Fig. 4.

The challenges of the global economy and financial system
• Debt problems in the EU, USA and Japan.
• Rising unemployment in developed countries.
• Increasing world prices for oil and food.
• Transfer of production in the country
with cheap labor (China, India).
• Currency War.
• Increasing impact of the SCO (China, Kazakhstan, Kyrgyzstan, Russian Federation, Tajikistan, Uzbekistan).
• The financial and economic situation in Japan.

External issues of Ukraine economy

• Lack of external funding opportunities and narrowing access to international capital markets.
• The uncertainty in financial markets.
• Slow recovery of the global banking sector and the global economy.
• Dependence of the economy on world energy prices.
• Choice of foreign-economic policy vector.

The challenges of
the global economy
and financial system

External issues
Economy of Ukraine

Internal problems of
public sector

The core system
of public finance

Internal problems of public sector	Trends (budget influence coefficient)		
	2012	2013	2014
The growth of public debt (external and internal)			
Unbalanced Pension Fund			
Endowement of "Naftogaz Ukraine" budget			
Implementation of projects and programs that create new jobs and trigger chain reactions in the economy			
Implementation of the modernization of production and energy efficiency technologies			
Failure to complete the administrative reform			
Reform of public administration and economics			
Political factor: Preparation for Elections			
Corruption			
"Demographic hole" (aging population), the reduction of labor capacity			
Conducting of Euro-2012 at high-level			

Figure 4.Concentric model of the trends of the medium-term budget planning

It should be noted that this model takes into account the challenges of the global economy and financial system, the external and internal problems of the fiscal sector. The core of public finance system reacts to all the problems and challenges in the form of trend models taking into account the integrated influence coefficient on the budget and the economy of Ukraine.

The integrated influence coefficient is based on the hypotheses on the conditional independence of the influence of trends or their groups on a budget of Ukraine and the lack of time aftereffects.

Key 2. Focus on value creation

A new paradigm of fiscal and target program management is considered, namely – focusing not on budget disbursement, but on values creation for the parties concerned. In this regard, it is necessary to determine the structure and components of the values for key stakeholders developing models and the value estimation methods (assets, skills, knowledge and innovation) and to implement these models and methods in the standard methodology of innovation development management.

At the same time, the goals are to be coordinated with the mission of the public finance system – are to be a driving force of reforms and economic development of Ukraine on the basis of innovative management techniques.

At the heart of the management paradigm implementation is the objective to meet the requirements of the society by eliminating all losses promptly and efficiently. In addition, one should refuse to create added value for all stakeholders.

The steps to management paradigm success will be:

- change in the way of thinking and behavior of the parties concerned;

- business processes optimization;

- improvement of system flexibility, i.e. its capacity and capabilities to adjust to the requirements and demand of the stakeholders in resource and product management;

- elimination of variability and prematureness;

- *cutting process duration*;

- tools application aimed at prevention of different kinds of overexpenditures.

Key 3. Transition to the knowledge economy

A model of knowledge and excellence is under consideration. It is based on the project approach, on the cognitive models of accumulated knowledge and on the technological maturity growth. These elements constitute the basis of the conceptual model of innovative development. The system transition to a new management concept requires to:

- build a structural model of accumulated knowledge;

- identify the source and knowledge content to be placed in the databases;

- prepare staff for the transition to formal knowledge display in bases;

- motivate the staff to knowledge accumulation and usage.

Key 4. Change management paradigm and create and use the formula for success

This kay takes into consideration the change of management philosophy on the example of the public finance system (see Fig. 3). As noted, the new government applies three fiscal policy patterns.

The success of this key is achieved through:

- formation of the vision of life cycles of products, processes and systems;

- building of the proactive model of development management paradigms;

- development of a formula for success based on trends and new philosophy management;

- implementation of a new management paradigm.

Key 5. Form a mental space and be creative

The major mission of the mental space based on teamwork, innovations and stakeholder satisfaction is to create an efficient, technologically mature public finance system. The most difficult task is to form mental space at a time of the administrative reform, moreover, this process requires innovative approaches. In order to implement such approaches the Internet technology within the knowledge and perfection Center, and the Virtual University is used. The Ministry of Finance developed a conceptual scheme of the creative model, which is the basis of the accepted approach.

The creative model core recomposes tasks at the entrance into the product at the exit with respect to the challenges, sending messages to the outer space. The creative models that are used are designed to reduce the task execution duration, ensuring the required quality of decisions and documents.

The creative models that are available on the Intranet site in the knowledge and perfection System are used in practice, namely: the basic, presentation, analytical, strategic, process creative models (templates) and the improvement template (Gareis, 2005; ICB 3.0, 2006)

The success of this key is achieved through:

- creation of a team and preparing it for the changes;

- achievement of the strategic credibility of professional groups;

- operation on the basis of the customer satisfaction criteria;

- orientation of management system towards perfection and competitiveness;

- usage of creative technology.

Key 6. Carry out the system reload

The authors have developed the program architecture, within the framework of which there are three main blocks: the basis, the projects (programs) and the innovative

mechanisms. The basic program components of the «public finance system reload» are the new Budget and the new Tax Codes.

An important step in the program implementation has become the administrative reform. In this case, the Ministry of Finance has developed a business game, the «Furor».

The successful implementation of such large-scale reforms in the public finance system resulted in the need for rapid, high-quality and effective training of all staff involved in the public finance system. Therefore, the Virtual University of the Ministry of Finance was established and is successfully operating. Today, more than 100 thousand public civil servants are being trained and take independent tests.

One of the major principles that form a strategic public confidence is the transparency of the public finance system (Kaplan & Norton, 1996; Kerzner, 2001a). Today, the information technologies and education technologies for stakeholders are developed and implemented aimed at the fulfillment of the control functions of the allocation and expenditure of the budgetary funds at all administration levels, down to the village level. The «Transparent Budget» system provides a full access to the stakeholders of the public finance system of Ukraine.

The success of this key is achieved through (Kerzner, 1998; Managing Sucessful Projects with PRINCE 2, 2002):

- development of a reload program based on the philosophy of life cycles;

- practicing the innovative mechanisms for development programs;

- conduction of education and training of stakeholders;

- implementation of the program with a focus on success.

Key 7. Create and develop the knowledge and perfection Center

The main task of this center is to provide training and independent testing for all parties interested in the public finance system reload,

based on the Virtual University, the accumulation of knowledge about the activities of departments, functions and tasks in a creative pattern form, templates, the development of technological maturity of the public finance system in Ukraine. To support our center we have prepared a large number of books, academic commentaries and textbooks in the field of public finances (Key Practices of the Capability Maturity Model SM; CMM-I Capability Maturity Model Integration, 2002)

The success of this key is achieved through:

- providing training and independent testing of all stakeholders within the Virtual University;

- accumulation of formal and structured knowledge about the activities of departments, functions and tasks in creative pattern form;

- the development of technological maturity of the public finance system.

Figure 5 shows an example of balanced indicators, which are used in the public finance management. Such a system directs the management process to the success (Kerzner, 2001b, PMI OPM3, 2003)

Raising living standards
- Expenditure on social protection and social security **+10%**
- Real wage **+9%**
- Living minimum wage for different groups of the population **+25,7%**
- Annual average minimum wage **+19,4%**
- Average scale of minimum pension +**19,5%**
- Average annual salary of the employee wage category IETC+**33,5%**
- Aid to families with children **+25,4%**
- Benefits and housing subsidies **+18,9%**
- Affordable housing provision – **increase by 5 times**
- Affordable housing provision for military personnel – **increase by 2,1 times**
- Expenditures on cash security for military personnel+**22,1%**

Saving and acceleration of human development
- Expenditure one ducation +**10%**
- Health expenditure +**8,9%**
- Expenditure on mental and physical development +**6,2%**
- Expenditure on research and scientific and technological activities +**5,5%**
- Expenditure on culture and art + **6,7%**
- Expenditure on mass media +**5%**
- Expenditure on culture and sports +**20,9%**

Economic and income unshadowing
- Revenues of the consolidated budget +**12,8%**
- Profit of profit-making enterprises +**17,5%**
- Revenue of tax on personal income +**17,6%**
- Payroll fund +**17,6%**

Creation off avorable business environment
- Redistribution of GDP through the consolidated budget- reduction to **28,7%**
- Provision of tax incentives and industry benefits

Modernization of infrastructure and basic industries
- Expenditures on economic activities +**2,3%**
- Expenditures on housing and community amenities +**4,8%**
- Investment costs in the consolidated budget ≥ **5% of GDP**
- State guarantees >**1% of GDP**
- State support for agriculture + **8,9%**
- Road Facilities +**14,3%**

Socio-economic development of Ukraine
- Real GDP +**6,5%**
- Exports of goods and services +**12,5%**
- Expenditures and credit extension of the consolidated budget +**10,9%**
- Expenditures on defence + **8%**
- The share of local budgets in the consolidated budget – **44%**
- Incomes of local budgets +**14,5%**
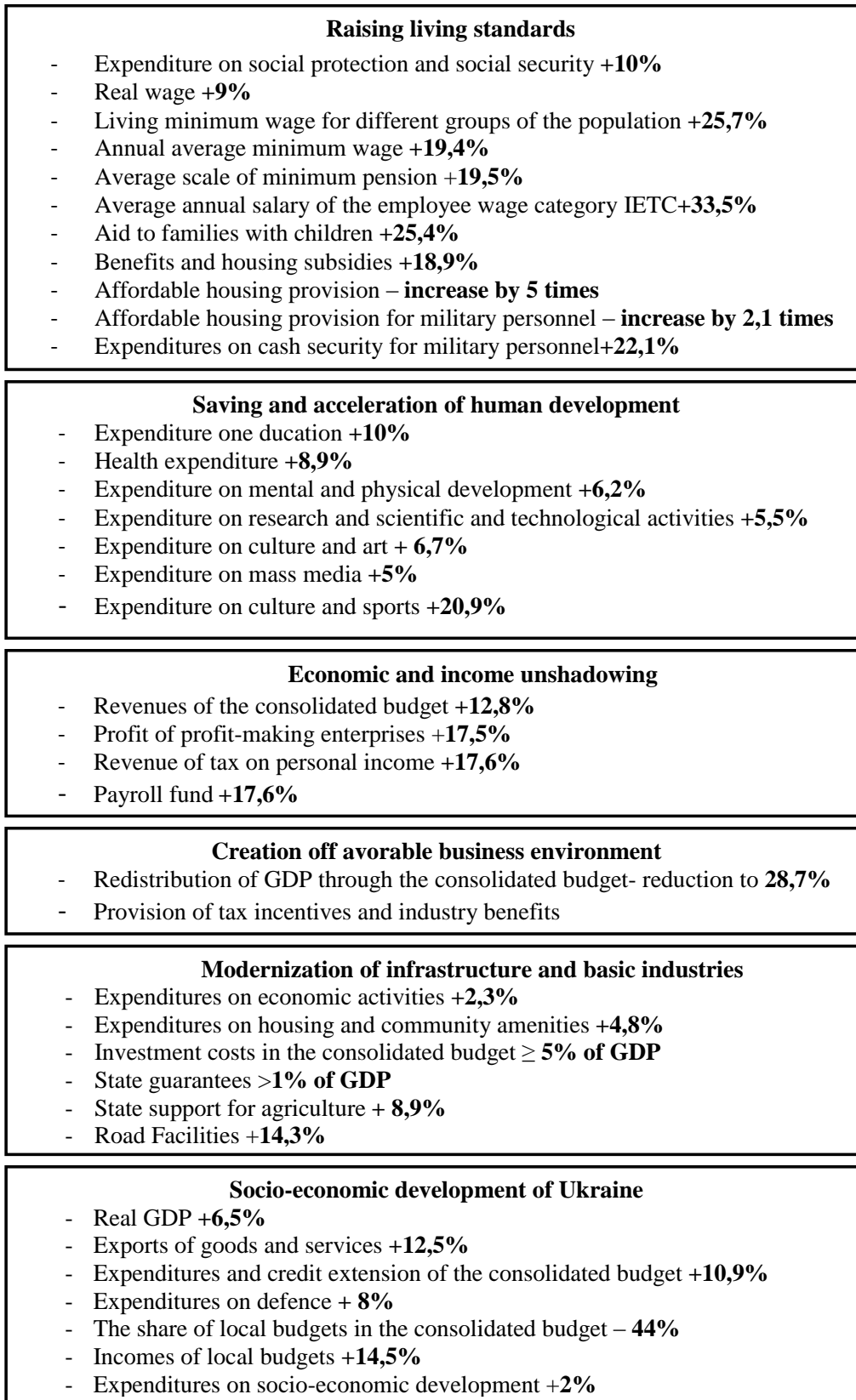- Expenditures on socio-economic development +**2%**

Fig.5. Example of balanced success indicators of program development public finance

CONCLUSION

Summarizing, we arrive at the following conclusions:

1. Keys to success, presented in the paper, allow for the development of a strategy for complex systems reform implementation, which include the system of public finance in Ukraine.
2. Innovative mechanisms, applied in system creation, add the necessary dynamics and aim at reform success.

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English Language I	English Language II
Mathematics	Informatics II
III Semester	*IV Semester*
Strategic Management	Project Management Software
Project Management Methods and Techniques	Marketing Management
Company Organization	Change Management – Opt.
Finance Management	Project Risk Management – Opt.
	Psychology and Management - Opt.
	(Two subjects can be chosen)
V Semester	*VI Semester*
Investment Project Management	Project Portfolio Management
Program Management	ICT Project Management
Human Resource Management – Opt.	Business Project Management – Opt.
Project Manager – Opt.	Project Management Organization – Opt.
Entrepreneurship - Opt .	Creating Business Plan – Opt.
(Two subjects can be chosen)	(Two subjects can be chosen)

GRADUATE STUDIES

VII Semester	VIII Semester
Contemporary Management	Project Management Methodologies
Strategic Project Management	Project Financing – Opt.
Project Leadership	Contracting Management – Opt.
Project Quality Management	Project Communications Management – Opt.
	Public-Sector Project Management – Opt.
	Project Oriented Organization – Opt.
	Project Change Management – Opt.
	(Three subjects can be chosen)

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Serbian Project Management Association (YUPMA) was formed as YUDRUP in 1986. In1997 it has become a full member of the International Project Management Association (IPMA). YUPMA and its members have so far taken part in a large number of national and international research and other project in the field of management.

CERTIFICATION

YUPMA offers the international certification through the YUPMA CERT programme based on the IPMA$^®$ certification programme. The YUPMA CERT programme objective is to test and verify the competence of candidates in project management.

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IPMA level C: *Certified Project Manager$^®$*

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YUPMA also organizes appropriate training in the field of project management via seminars, courses and lectures delivered by both our and foreign experts. Training courses are organized periodically or at the request of a company or another organization. YUPMA's standard offer includes a number of seminars and courses which can be geared to the specific requirements of the participants. On completion of any seminar the participants receive a certificate.

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- Managing the EU projects

- Business Plan Preparation

- Project Management in Specialized Fields (health-care, education, public administration,...),

- Project Management Software Packages (MS Project, Primavera)

SYMPOSIUM

One of YUPMA's major tasks is the organization of symposia bringing together the experts engaged in project management and related disciplives. One of the major objectives of these scientific meetings is to describe the position and the development of project management in Serbia and in the region. So far, fiveteen symposia on project management have been organized and they are traditionally held every spring on the Mount of Zlatibor.