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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 specialized management disciplines.

The development of project management 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 Jovanović

President of Serbian Project Management Association YUPMA



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YOUR PROJECT MANAGEMENT EFFORT SHOULD BE PLANNED AS WELL IN ORDER TO PROACTIVELY BALANCE AND SCALE YOUR PROJECT MANAGEMENT EFFORT

Morten Fangel - *Fangel Consulting Ltd, Denmark*

Abstract: When managing projects, the focus is on how to *perform* project management activities, as well as on the execution of project activities themselves. *Leading* the project management – including *planning* and *evaluation* of the effort itself – is primarily carried out intuitively and based on years of experience, or accomplished by following a pre-determined standard for project management. However, a more *conscious* and *systematic* planning and evaluation of the project management effort in all its aspects is needed to balance the effort – for several reasons which will be presented at the Congress. The main steps toward achieving a more systematic approach to leading the project management are:

- *Clarifying* the project situation and characteristics as well as the project management challenges and future initiatives.
- *Extracting* activity plans for the project management effort.
- *Evaluating* the performed project management activities, including documenting the performance of the activity in a logbook.

This paper is based on the book *Proactive Project Management* (Fangel, 2013).

Key words: Planning project management, Project management complexity, Evaluating project management.

1. AN EXAMPLE OF PLANNING PM EFFORT

Let us start with an example of conscious dealing with management effort in a project:

John has just been appointed project manager of a new project. He had expected his new project to be postponed until his current project was closer to completion, but unfortunately, it did not turn out that way. "It is a really exciting project", and "you are just the right man for the task," the project owner had said at the just-terminated meeting that Paul has just left.

Later that day at lunch, John meets Helen who participates in his current project. "Congratulations on your new

job – I just saw on the web-site that you were the lucky guy! How do you intend to approach the management of the new project"? "How"? John looks speculative and replies: "I have not had time to consider it in detail".

While Helen goes on talking about her holiday plans, John wonders why she asked that question. Later, his thoughts return to the start of their common project, into which he had also rushed headlong. It really had taken a considerable amount of time before he succeeded in activating the other participants in the project. During the first months, he had done almost all the work alone – anyhow, that was how he had felt it.

Now John feels very determined. "This project should be different", he thinks.

“I must do more to activate the participants – but how? Everybody is so busy”. John decides to write an e-mail explaining how he suggests the new project should be approached. Then, when he has discussed the content with the project owner, he will send the e-mail to the future participants.

But what should be included in the plan for his project management? He chooses to play back his preliminary ideas to Helen: “It sounds as if you are going to have a really exciting holiday. But I wonder if you – before you leave – could spend some time with me to discuss my new project. It seems as if you have some ideas – and, in any case, I would like to have your views on my plans to get a better start of the new project. I think you know my points”. While Helen considers his question, John reflects – and continues: “And when you come back from the holidays, let’s have a talk about the management

of my new project”. Helen agrees and promises to drop by his office in the afternoon.

Paul was inspired to start on what we call “to plan and evaluate the management effort in a project” – or, in brief, to *lead the project management*. The *leading* of the project management takes place consciously or unconsciously in parallel with the process to *perform the project management*, which includes well known activities such as planning, arranging meetings and sparring with the participants. See Figure 1.

This paper deals with how you can *more consciously* plan the management effort in the coming period, or in a current situation in your project – how to transfer your knowledge of the project and the situation to concrete managerial initiatives.

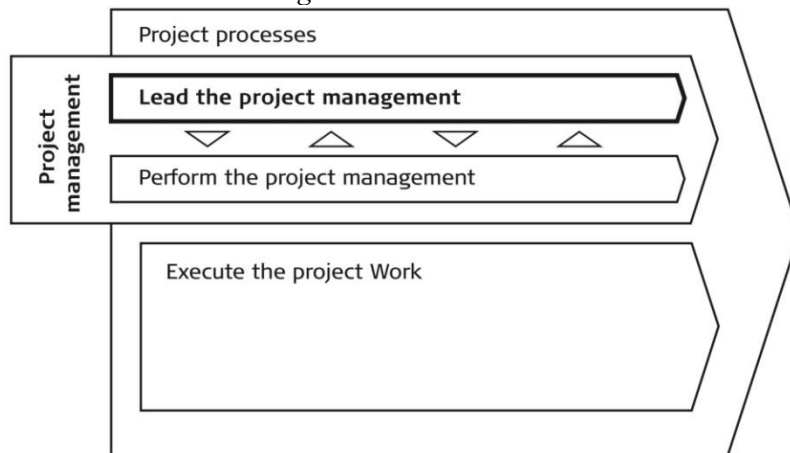


Figure 1: In the overall project management process, we distinguish between: to lead the project management and to perform the project management

2. THREE LEVELS OF GUIDELINES FOR MANAGING PROJECTS

Before presenting a method for

planning project management, let us have a look at a three-level division of guidelines for project management that you may have in a project-based company. The levels of guidelines

correspond to the levels of processes in Figure 1: Execute the project work, perform the project management, and lead the project management.

The relations between the levels of guidelines and the levels of the project processes are illustrated in Figure 2:

- A classic *project model* – or project execution model – provides an overview of the project processes and accumulated experience from the type of the project in focus. The project model includes, for example, project break-down structure, main milestones, organisation form, task distribution, and structure of documents.

One way to use a project model is to directly perceive it as a template for implementing a project process. See Arrow 1 in Figure 2. This could be realistic in cases where the project model is for a specific type of project – and if the current project is rather

repetitive. This corresponds literally to obtaining a “ready-to-wear” project plan – and making minor adjustments to the current project.

Another way of using the project model is to treat it as a compilation of experiences from which you can pick when planning an actual project. See Arrow 2 in the Figure. In this case, the project plan is “tailored” – but the process could be eased by picking from the model.

- Another level of guideline is a *project management model*, which provides an overview of the project management processes and provides generic guidelines for managing several or all types of projects in the company. Typically, the model indicates the management phases marked with main milestones, type of management activities and management roles.

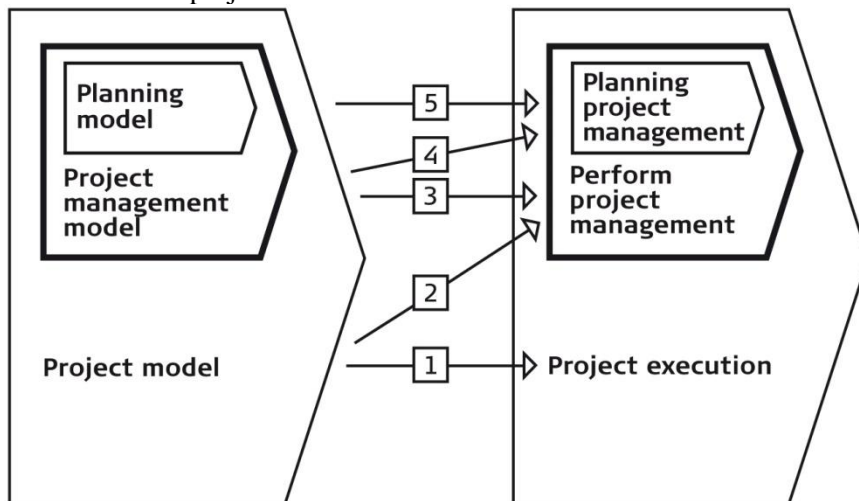


Figure 2: Coherence between the levels of the models and levels in the project process.

- One way of applying a project management model is to perceive it as a template for implementing the project management process. See

Arrow 3 in the Figure. Another way is to perceive this model to be a frame of reference and a source of inspiration for the planning and

evaluation of project management.
See Arrow 4.

- A third level consists of a *planning model* with steps and other guidelines for planning and evaluating the management itself. This model is supposed to be so generic that generally it can be used directly as a template. See Arrow 5. This third level of guidelines is the topic of the present article.

In actual practice, you do not have the choice only of one type of guideline or another. The company's project guidelines will typically be a combination. However, the argument of this paper is that the focus of guidelines should be shifted from project models over to using project management models – and towards models or methods for planning and evaluating the management.

3. THE NEED FOR PLANNING AND EVALUATING MANAGEMENT EFFORT

The core of being a professional project manager is that you know instinctively the amount and type of management effort to be used in a specific project situation. Add to this that we, by and large, always work under time-pressure in projects – so why also spend time for planning the management?

In the area of competence development, we distinguish among four levels: unconscious incompetence; conscious incompetence; conscious competence; and unconscious competence. It might be felt as a constraint – having to fit your own intuition into a “method”. However, the best advice is to try to consciously plan project management – not as an alternative, but as a support for the development of your own intuition and solid judgement.

There are many reasons for focusing more consciously on planning and evaluating the management effort in projects.

- It is a tendency of the *natural law* in dealing with projects that we slide into “content mode” – even when it is vital to be in the “management mode”.
- It serves to promote utilisation of the organisation's *guidelines for project management* by raising the questions about which parts should be applied in the particular project/situation.
- Limited time and resources for project management make it important to *focus* the management on those efforts that create the most managerial value for the project.
- Increasing *expectations* – both from external and internal parties – regarding the actual management of the project points at the need for verification of the actual management effort.
- Description of the requested management effort makes it easier to *involve* both project owner and project participants in the management activities.
- Demand is increasing for *ongoing learning* and improvement – also concerning management of projects.

Which of these reasons is especially relevant for you – in your project and your organisation?

Planning the project management effort should typically take place at the critical points of the project – such as, for project preparation, project start-up, project evaluation, and project close-down. Of course, it is also relevant during the management of the project execution to go through conscious

planning and evaluation of the management effort.

4. METHODS FOR PLANNING PROJECT MANAGEMENT EFFORT

The central element in planning the project management effort is to consciously realise what the managerial problems or challenges will be during the period in question. In other words: Where could managerial value be created?

In the example from the introduction, John might have a clear option regarding this challenge – to activate the project participants earlier than last time. But who can say that John has faced all the challenges? Let's hope that Helen will help him consider any other managerial challenges when they meet.

When the challenges are clarified, a simple method is to “brainstorm” on possible management initiatives – among which might be to visualise the common objectives for the project and to arrange a project start-up meeting for further clarification.

As a method for the overall planning and evaluation of the management effort in a project, we recommend the 10 steps in Table 1. The basic concept is first to *clarify the future management effort* and to *summarize the results in an overall plan for the project management*. Based on this, *the future management effort is specified as an activity plan for the project management* – and perhaps programmes for management meetings. Later, a stepwise evaluation of the *performed project management* is carried out.

In the example with John and Helen, STEPs 1, 2, 3 and 4 of the method can be utilised as a simple agenda for their discussion. This is not to say that they should accomplish the items step-by-step without reflecting. The steps should rather function as a framework for their discussion, and as an inspiration to allow consideration to move from the first steps toward the last ones – and to a lesser degree vice-versa.

STEP 1: The situation is that Paul has just been appointed project manager. Other things might be added, but let us stick to this information to simplify the example.

STEP 2: Paul's feeling is that the project is more complex than the one he is just about to finish.

STEP 3: His first reaction to the challenge is that “I must immediately study the new project--

STEP 4: -- by examining the available project description together with the project owner in a separate meeting room”.

Based on the inspiring talk at the meeting with Helen, it is recommended that John prepare an activity plan as a diagram covering the STEPs 5, 6 and 7. STEP 5 with activity initiatives will be used to examine the available project description, STEP 6 with the role initiatives indicates that this examination should be made together with the project owner – and STEP 7 with method initiatives suggests that the meeting be organised in a separate room.

Table 1: Method for planning and evaluating project management

Clarify upcoming project management	• STEP 1: Facts of the project and its situation	Where
	• STEP 2: Characteristics of its management complexity	Why
	• STEP 3: Challenges for the project management	What
	• STEP 4: Initiatives for handling the challenges	How
Specify upcoming management activities	• STEP 5: Content and timing of the activities	When
	• STEP 6: Role division of the activities	Who
	• STEP 7: Methods/tools for the activities	How
Evaluate performed project management	• STEP 8: Register performed activities	When
	• STEP 9: Evaluate the specific activities	What
	• STEP 10: Evaluate the entire management effort	How

The method also implies that John – for example, in the same document as the activity plan as STEPS 8 and 9 – should register and evaluate the actual management activities. And, after the first phase of execution, he should arrange as STEP 10 an evaluation and sparring meeting with Helen.

The advantage of using the 10-step method in Table 1 is that it helps you keep focus on planning and evaluating the *management* – and, consequently, prevents distraction into considerations that deal with solving project management tasks – yes, even to entering into project execution.

The example with John and Helen seems to be rather straightforward. But

experience shows that an extra effort is needed to get the planning of the management effort on the agenda, and also to maintain focus on the topic during a meeting until the up-coming project management has been clarified.

5. INSTRUMENTS FOR FOCUSING ON THE PLANNING OF PROJECT MANAGEMENT

In practice, three types of instruments have been proven to promote the conscious and methodical leadership of the project management:

- *Tools and related documents*
Four types of documents can promote both planning and

evaluation of the management effort:

1. Initial exploration is documented under the title 'Clarifying up-coming project management'.
2. The clarifying is concluded in an 'Overall plan for project management' to promote focus on the most important aspects. This document can be arranged according to the first four steps of the method.
3. 'Activity plan for the project management' converts the overall plan into detailed plans, including deadlines, distribution of tasks and method proposals.
4. In the 'Logbook for project management', the performed management activities are documented and evaluated according to STEPs 7, 8 and 9.

- *Dedicated planning meetings*

Some planning meetings should be dedicated to evaluation of the ongoing project management and to planning of the project management for the next period. STEPs 1, 2, 3 and 4 make an appropriate agenda for such a meeting.

- *Utilise sparring partner*

1. A perfect solution is for the project owner/sponsor to act as a sparring partner for the project manager concerning management of the project.
2. Another possibility is to use colleagues for sparring, either ad hoc (as it was in the case with Helen and John) or in a more formalised network.
3. A third possibility is to hire an internal or external consultant.

Typically, a planning meeting is held at the beginning of those phases that imply important management effort –

such as the project preparation, project start-up, project evaluations, and project close-down. Natural participants are the project owner/sponsor, the project manager, and other key persons.

The meeting between Helen and John could be considered as a planning meeting

6. DESCRIBING THE STEPS OF THE PLANNING METHOD

The following sections specify each step of this conscious planning and evaluation of the project management. The plan should be elaborated for a specific period of the project – because, if the plan is extended to cover the whole project, the contents might be too general and will not promote a suitable management effort.

6.1 CLARIFYING UP-COMING PROJECT MANAGEMENT

Planning the project management should be initiated by *capturing information* through a brainstorm-like process. This utilises the participants' intuition and experiences and gives them an opportunity to unfold their creativity. The following scheme can be used to prepare PM planning for a coming period – typically one to two months.

STEP 1: Facts of the project and its situation

Project definition and stage – in brief.

Explain the project aim, process, and/or organisation.

Could be extended by a review of the logbook for project management from the previous period (see STEPs 8 and 9).

STEP 2: Characteristics of its management complexity

Describe conditions which are

determining the management effort in the project. Examples are environment, cross organisation, etc.

STEP 3: Challenges of project management

The managerial challenges or problems. How can the project manager contribute to the project to achieve, for example, a common view or a more positive climate?

STEP 4: Special initiatives for “coping with challenges”

Management initiatives which make it easier to cope with challenges.

These could be proposals for management activities, such as analyses, planning, communication and follow-up, or proposals for management roles and methods and types of meetings.

All with the focus on what is to be done in addition to what would be done by routine – that is why the title of the step is *special* initiatives.

The first four steps aim at being used as an agenda for a planning meeting between the project manager and one or a few others.

6.2 OVERALL PLAN FOR PROJECT MANAGEMENT

An overall plan for project management can be established after a creative clarification – and can be structured according to the method’s STEPs 1, 2, 3, and 4. The task is to extract the essence of the clarification steps – not to make a complete documentation of the clarification that might have been made earlier in a separate “interim paper”.

As to the overall plan for project management, I recommend the following:

- Restrict the scope definition to only one page – it is difficult to stick to the plan’s intentions during a stressed normal day.
- List the contents as items – typically 3 - 5 items per step in the method.
- Focus on the most meaningful and significant management efforts – and refrain from describing that part of management that takes place irrespective of being listed in the plan.

Please note that such an *overall plan for project management*, both in structure and contents, is similar to an invitation to a project start-up workshop – for example:

1. *Facts of the project and its situation.* A brief introduction to the project and a description of the direct cause for having the workshop now.
2. *Characteristics of its management complexity.* Conditions in and about the project indicating that a workshop is a relevant initiative.
3. *Challenges of project management.* The aims of the workshop and the expected effect.
4. *Special initiatives for coping with challenges.* The main programme for the workshop, including type of analysis, planning and co-operation development. Furthermore, it should be stated who might prepare presentations, and whether items in the programme are purely informative or require a broad involvement. Also, information about facilities and tools for the entire workshop should be given.

A refinement of the planning method includes supplying a checklist for each of the steps. Experience shows that such tools are most helpful for

structuring and checking the results from a more open debate. Further, the checklists are useful for editing results from the exploration. If the checklists are used as a starting point, the output may be too extensive to apply in practical overall plans for project management.

6.3 ACTIVITY PLAN FOR PROJECT MANAGEMENT

The aim of the overall plan for project management is to create an overview and to hold on to important matters concerning interaction in the management effort during the period in question.

Further, a more operational activity plan for the management effort is necessary. We here recommend issuing a separate plan for the management activities. A simple format is just to list activity terms, periods, task distribution, and practical recalled experience. In small projects it can be part of the detailed project plan for the execution.

STEP 5: Content and timing of the activities. Transform specific management activities into a chronologically arranged list assembled on relevant topics.

STEP 6: Role division of the activities. Who is responsible for, or who contributes to, these management activities? What is the role of the project manager in the specific activity? Should the project owners and/or the project participants be involved in the planning? Which resources could be implied?

STEP 7: Methods/tools for the activities. How could the chosen management activities

be conducted in practice?
Which methods/tools, examples or practical hints?

6.4 LOGBOOK FOR PROJECT MANAGEMENT

To promote a conscious follow-up and evaluation of the project management effort, it is valuable, as STEPs 8 and 9, to generate a separate logbook for management of the project – not to be mixed up with a logbook for the entire project.

The aim is:

- to become more conscious regarding the project management roles,
- to plan additional management initiatives, and
- to achieve more learning about project management.

The best way to achieve this aim is to keep the logbook continuously – otherwise you will soon forget the things “that kept you awake” and the considerations that crossed your mind at a particular time.

The logbook could include columns for:

- *Activities of project management*, including meetings and other events.
- Documentation of performed *management roles by activity* – and perhaps the amount of hours spent per activity/event.
- *Evaluation of performed management* – positive as well as negative.

7. IMPLEMENTING PLANNING AND EVALUATION OF PROJECT MANAGEMENT

As project management consultants, and when acting as a coach for project managers, we have applied the described methods in our own projects. This has, on the one hand, indicated

how systematic planning and evaluating can promote proactivity of the project management effort.

On the other hand, our applications in practice confirm how easily you can forget all about planning and evaluating the management effort, including your own performance – and instead concentrate on performing the project management activities and events, or even project execution activities.

To promote the planning and evaluation of project management, we recommend that this topic should be included in the guidelines for project management in your organisation. Yes – even to re-write your guidelines in order to ensure more focus on demands for this issue and less demand for utilising specific models and methods. Initially, project managers may consider this to be more demanding, but the actual essence is that it will ensure more freedom to select what they consider to be the best

way of performing project management in their projects.

Another application of this focus on level three in a project model – see Figure 2 - is the development of the Danish National Competence Baseline, NCB (Fangel edit 2010) – based on the IPMA Competence Baseline, ICB issued by the International Project Management Association. In this NCB, we have decided to include *planning and evaluation of project management* as a major component of project management competences – shown as Section 1 in Figure 3.

The main argument for adding this element to the competence standard is that the capability to reflect on your project management, and to be creative in selecting your project management approach, is one of the major differences between being a project manager and being a senior project manager!

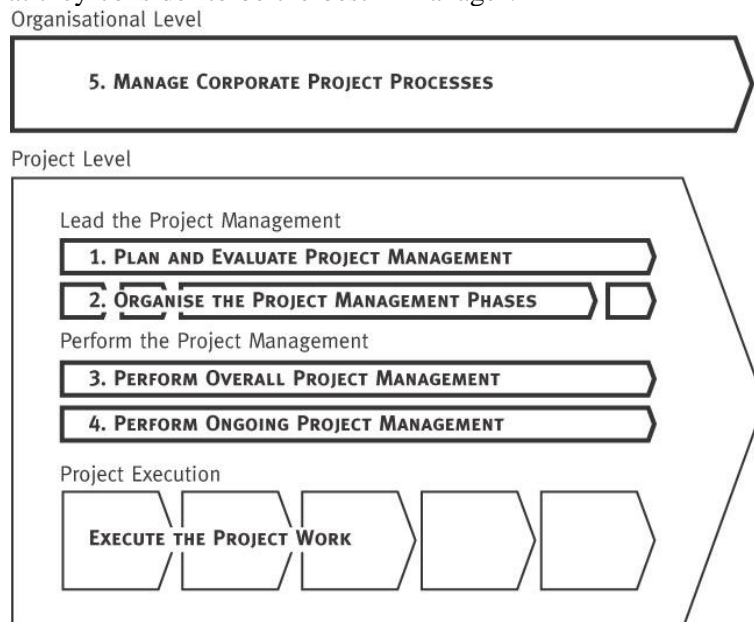


Figure 3: Five sections of project management competencies in the Danish National Competence Baseline – of which the first section is to plan and evaluate the management effort.

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CHALLENGES IN DEVELOPING PROJECT OFFICES IN THE MANUFACTURING COMPANIES

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Abstract: Under modern business conditions, the project approach and effective project management are both widely recognized by the organizations as key factors for achieving the strategic goals. In this paper we will endeavor to point out the benefits that an organization may have from developing a project maturity by establishing and developing the project management office (PMO). The purpose is to develop an understanding of how the project management offices contribute to the development of project maturity within an organization and which are the challenges faced by a manufacturing company. In this paper we point out the fact that project management maturity is one of the strongest change drivers to project management offices. That indicates that the important measure of PMO performance is the ability to improve project management practice and its performance.

Key words: Project management, Project Management Office, Project maturity, Manufacturing companies

1. INTRODUCTION

Today, organizations are facing the fact that the implementation of strategy is more difficult than its formalization. Kaplan and Norton argued that the organization can use project management for successful translation of strategy into its objectives and actions and for strategic implementation (Robert S Kaplan, 2008). Therefore, there is a strong linkage between business strategy, project portfolio management and business success. They are used for closing the gap between strategy formulation and implementation. It is known that in modern business achieving strategic goals requires the implementation of a large number of different projects. In these cases, the organization has to change and implement different business processes, communication systems and organization structure.

The concept of the project management office (PMO) has been in use for a number of years but recently, as business rules have changed, the PMO has gained a popular organizational role. It is found in different areas within an organization at the departmental level, or on the the enterprise or corporate levels. Many years ago the PMO used to have a responsibility to control a realization of a singular project. Nowadays, the PMO does not provide support to project management community; it rather seeks data from the project management community. The PMO should be an

arm of senior management in helping the executives meet strategic goals.

Projects and project management are recognized as the essential factors for achieving strategic goals, since the scarcity of resources is one of the most important characteristics of modern business. Project management is seen as a flexible, efficient and strategic management system that is used in achieving the planned results in traditional management structures. However, under modern conditions, the achievement of strategic goals requires the implementation of a large number of changes, including: the application of contemporary management of business processes in the organization, the introduction of new information and communication systems, the changes in the organizational structure etc. a successful introduction and implementation of the project approach should be supported by the establishment of an appropriate organizational unit for project management – the Project Management Office (PMO). By forming this organizational unit the company provides support for strategic decision making and effective project and portfolio management. In that way the organization ensures a sustainable growth and development of the organization. The project maturity of project-oriented organizations will be represented by a model of project maturity which can measure the ability of an organization to implement planned projects and present the steps that should be taken

to achieve an excellence in project management. This paper reviews the benefits and challenges faced by a manufacturing organization in the area of establishing and developing the project management office. The paper also highlights the role of the project office in definition and implementation of projects within the company. The current level of project management maturity of this manufacturing company will be presented along with the actions which should be taken in order to develop project maturity.

2. PROJECT OFFICES

The most common reason a company starts a project management office is to establish and maintain procedures and standards for project management methodologies and to manage resources assigned to the projects in the PMO (Heldman 2003). The PMBOK® Guide (PMI 2004) defines the PMO as: An organizational body or entity assigned various responsibilities related to decentralized and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing project management support functions to actually being responsible for the direct management of a project.

The goal of organizational project management is not just to deliver projects on time, within the budget and in line with the desired technical and quality specifications. The main goal of project management is to create value for the business. The PMO supports the accomplishment of business objectives through translating strategy into portfolios of projects and programs. Beside this, the PMOs increase the organizational capacity to deliver successful project performance in terms of cost, schedule and quality. The role of the PMO is strategic due to the fact that it provides information for better decision making.

The implementation of many PMOs has failed in the absence of a clear purpose and effort to contribute to different expectations of key PMO customers and stakeholders. Aubry has found that many organizations implement the PMOs without a clear direction and vision of the role they want the PMO to play and the organizational needs (Aubry, Hobbs, Müller, & Blomquist, 2010). Both tactical and strategic aspects of project management are important for the implementation of project

approach and PMOs into an organization. To deliver successful project it is necessary to have it aligned with the organizational strategic orientation. If there is a gap between tactical and strategic aspect, the PMO will not be effectively implemented.

The identification of PMO's value is important for a successful implementation of the PMO within the organization. It is not an easy task since its value is hidden within improvements and intangibles that are hard to quantify. Each deliverable or service of the PMO should have a payoff that should be quantified and linked to the stakeholder(s), showing a logical cause-and-effect relationship (Thiry 2008).

Turner identified several PMO success factors (Thiry 2008) (adapted):

- Link every PMO initiative to organization's business objectives
- Deliver value now. Focus on quick wins with tangible results
- Work on short-term initiatives and long-term solutions
- Focus on high value/high impact projects
- Communicate with the stakeholders of the PMO and identify their interest in projects
- Simplify and improve processes
- Measure, evaluate and reward compliance
- Measure and quantify PMO value.

The success and influence of the project management office depends on its position in the organizational structure. Other functional units have often seen the PMO as their enemy or as a powerless entity. A PMO must be able to help executives with the execution of the strategy, as determined by project mix and flow, or the PMO will not achieve sufficient level of value to sustain itself (Kendall & Rollins, 2003).

The PMO achieves its objectives by focusing on the integration of people, processes and tools (PPT) (Thiry 2008). There is an opinion that a major role of the PMO is to focus on tools, by implementing a project, program or portfolio management system. However, the PMO could not achieve organizational objectives without emphasizing the importance of people and processes. The people aspect focuses on providing the human resources with required knowledge and skills, training,

mentoring and empowerment to deliver successful projects. The third element, process, links people and tools and it is considered to be a set of practices performed to achieve a given purpose.

Research shows that around 70% of large organizations have some form of PMO (Kendall & Rollins, 2003). The most common reason for establishing a PMO is to ensure the implementation of the project on time, within a planned cost and quality. The main aim of PMO is to increase the success of projects and programs in achieving strategic goals. The PMO can contribute to achievement of strategic goals by a more efficient use of project resources and a more effective use of scarce skills and resources across projects and programs.

The PMO has a several functions. First of all, it is responsible for improving project execution and performance through improving capacity for delivering project efficiently by standardizing processes, methodologies, tools, templates and training. The PMO has to align the project, programs and portfolio with the business strategy in order to select and implement the right projects which are crucial for achieving organizational objectives. Governance of the portfolio, as a third function, includes setting standards and processes, as well as establishing governance mechanisms like stage-gates to ensure that the project or program is still critical to the organization and to adjust or re-align the project as necessary (Thiry, 2008). The PMO provides the necessary information for monitoring and tracking the project progress and quality and provides a platform for communication with various stakeholders.

The PMO forms in modern business environment are (Jovanović, Petrović, Mihić, & Obradović, 2007):

1. Project Control Office, PCO
2. Project/Program Office
3. Project Management Center of Excellence PMCOE
4. Strategic Project Office SPO

The PMOs are developing through five phases and becoming centers of excellence. The first issue the PMO has to deal with is the lack of standardization where project and program management levels are inconsistent producing unpredictable results. Based on that, the first stage of developing PMOs is standardization where standards and practices are established through creating project and process management framework and providing training in these standards. The next stage is measurement: monitoring and reporting critical information. At this stage the project metrics and KPIs are defined, collected and measured, results are in line with plans and changes and risks are managed. Control is the third stage where the project and programs are integrated into a portfolio and contingencies are well managed. For the PMO it is important to consistently and continuously manage portfolios where innovations and optimized usage of resource are emphasized. When the PMO reaches this level it is at its fourth stage – the stage of improvement. As mentioned before, the final stage is the PMO becoming the center of excellence, a key enabler in executing business strategies and delivering results aligned to balanced portfolio.

The evolution of the PMO is consistent with generic process models which are the basis of project management maturity. That means that establishing the PMO means that PM maturity can be conducted (REF).

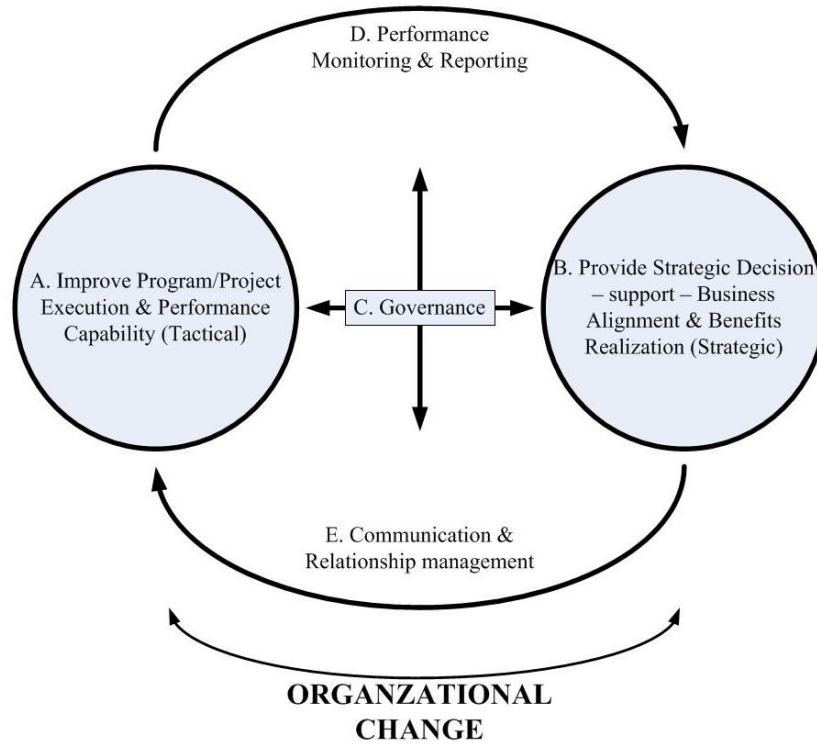


Figure 1: Framework for PMO: areas of focus (Thiry, 2008)

The transformation of the PMO is an organizational project even though research shows that it is not considered to be a real project of organizational change (Aubry, et al. 2010). Also, there is a significant relationship between transformation of the PMO and project portfolio management. The PMO transition can have a positive impact on portfolio management either in the context of a particular issue or as a result of the change in PMO functions and supportiveness (Aubry, et al. 2010). Research also shows that PMO transformation is undertaken as a business response to solve existing issues and such outcomes are expected from this transformation. The particular changes to the PMO are most likely influenced by the specific organizational context, and no general pattern of change exists. The transformation of the PMO has the assignment to implement project management culture through methods, standards and tools. Many authors have recognized the fact that there is an emptying process as project management becomes embedded in the organization's routines after the transition of the PMO. But there is a need to update processes in order to improve performance and adjust to internal

and external changes. It is necessary that the organization and the PMO are realigned as time passes. Project management offices (PMOs) are dynamic organizational entities, frequently in transition from one charter and structure to the next.

3. PROJECT APPROACH AND MODEL OF PROJECT MANAGEMENT MATURITY

The purpose of this section is to show the reasons for adopting a project approach within the organization as well as the project maturity model, which indicates the level of project approach adopted in an organization.

In modern business environment, where changes are unpredictable and frequent, organizations have to adapt their strategic processes very quickly in order to face changes in their environment (Hobbs Brian, 2007). Many organizations have recognized the importance of implementing project approach in the organization. The translation of strategy into programs and projects is recognized as a core process (Morris & Ashley, 2004). By performing strategic planning for a project management organizations want to secure a

Competitive advantage (Kerzner, 2001). The benefit of applying the appropriate project methodology reduces working hours, expenses and resource usage without sacrificing quality.

The gap analysis is a key process for reducing disadvantages that may exist between the organization and its competitors. For an organization there are two important gaps: the gap between the organization and the industry average, as well as between the organization and the main competitor. With the gap increase, the risk that is taken also increases. Three critical gaps that are important should be analyzed are : speed of market entry, competitiveness in costs and competitiveness in quality.

Applying the appropriate project methodology should result in benefits such as the reduction of working hours, expenses and resource usage, without sacrificing quality.

Strategic Planning Project Management combined with appropriate project methodology may reduce the gap in costs, time and quality. Strategic planning ensures the excellence in project management, taking into consideration all aspects of the company, starting from the relationship between employees and management, through the role of a number of participants, especially project sponsors, to the corporate structure and culture. Effective strategic planning and implementation of appropriate project methodology may be crucial to achieve a long-term success or failure. Strategic planning for project management involves the development of a standard methodology for project management that will be continuously used and will provide a more certain achievement of project objectives. Critical success factors of strategic planning and project management are the activities that must be accomplished in order to achieve long-term goals of the organization success. There are three critical factors of success: qualitative, quantitative and organizational factors (Kerzner, 2001).

When we talk about project maturity within an organization, we refer to a certain degree of maturity and we make an effort to measure or characterize the maturity of the organization. Measuring maturity is subjective rather than objective. Some authors focus on the operational aspect of projects when explaining project maturity. On the other hand, there is Skulmoski who explains the organizational project maturity as the organization's receptivity to project management (Skulmoski, 2001). He believes that competence and maturity are two most important factors for project success. There is also a view that maturity within the business community is best explained as the sum of action (ability to act and decide), attitude (willingness to be involved), and knowledge (an understanding of the impact of willingness and action) (Erling S. Andersen, 2003).

Achieving excellence in project management can be described using models of project management maturity which are comprised of five levels (Project Management Maturity Model PMMM)(Kerzner, 2001). Each level represents a different degree of maturity in project management. Some of these levels may overlap and that depends on organizational risk preferences. This involves three levels of risk: low, medium and high. A low risk has no impact on the corporate culture, a medium risk means that the organization recognized the need to change but is not aware of the impact of changes, and a high risk means the implementation of projects results in the corporate changes.

The levels of project management maturity model are (Kerzner, 2001):

1. Level 1: Common language
2. Level 2: Common processes
3. Level 3: Singular methodology
4. Level 4: Benchmarking
5. Level 5: Continuous improvement

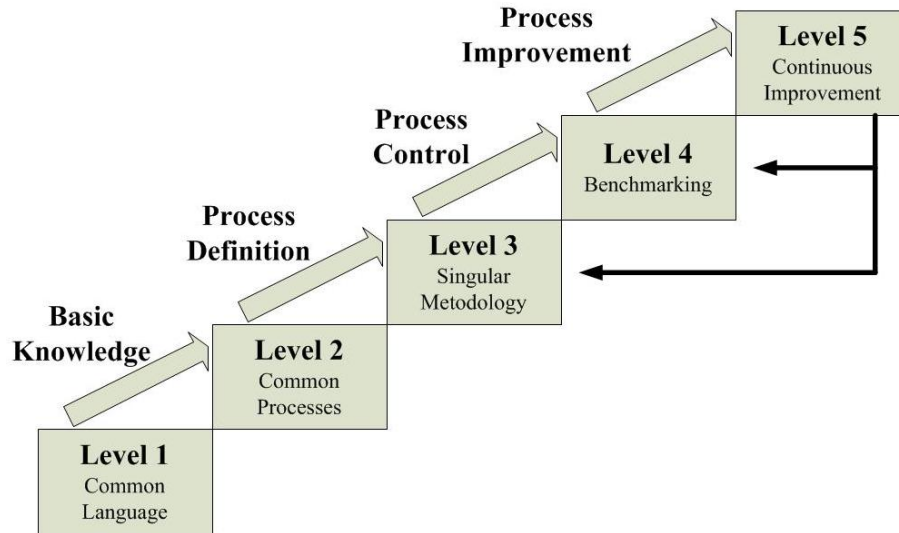


Figure 2: Levels of project maturity (Kerzner, 2001)

The first level is the *level of common language* where the organization recognizes the need for introducing project management in the organization but its implementation is not completely supported. There is a belief that project management implementation will cause a cultural shock. Functional managers will be forced to surrender some or all of their authority to project managers. In order to resolve problems at this level the organization has to arrange training and education in project management and identify available project management tools. Characteristic of this level is that the top management and the middle management do not provide significant support to the project management and the executive level does not exist. Besides, there may exist small “pockets” of interest in project management, with most of the interest existing in the project-driven areas of the firm. Managers may worry that the new project management approach will threaten their authority and power because of that, consequently, there is no effort to learn about the benefits of project management. Due to the previously-mentioned, they make decisions that are the best for the decision maker and not for the organization as a whole. Also, on this level of project maturity, there are no investments and support for the education and training of project managers (Kerzner, 2001).

The *level of the common process* involves the use of a unique methodology and processes which enable the success of a project to be repetitive

rather than coincidental. Resistance exists in the second level, too. Functional managers feel a fear of losing authority and there is a fear that the new methodology may lead to rigid policies and procedures. The company has to develop a culture that supports project management, enabling people to see short- term and long- term benefits from incorporating a project approach. Besides culture, organization has to develop a project process and a project methodology. At this level of project maturity, benefits of using project approach are recognized and supported on all levels of management. Benefits are measurable and tangible. The most common benefits include lower cost, shortened schedules, no sacrifice of scope or quality, and the potential for a higher degree of customer. The organization is devoted to defining unique project processes and methodologies that can be used continuously.

Characteristics of the *level of singular methodology* are that processes are integrated, project management has gained cultural and management support and benefits from project training and education can be described both quantitatively and qualitatively. Project management is integrated within quality management (Total Management Quality TMQ) and competitive engineering. A fear of losing power and senior management unwilling to share responsibility make the difference between the third and the fifth level of project maturity. Corporate culture at this level requires effective management support at all levels. A critical

problem, in this case, is between the project and line managers.

Benchmarking project management is a continuous process of comparing the management practice of a certain business with that of project leaders in the field. There is a difference between a competitive benchmarking and a benchmarking process. The former focuses on quantitative outputs and critical success factors and the latter concentrates on the functioning and performance. On this level the project offices or centers of excellence are developed within an organization. All organizational levels are committed to improving project management processes.

At the *level of continuous improvement*, the company realizes that achieving and maintaining excellence is a never ending process. The important fact is that strategic planning project management is recognized as a continuous, ongoing process. The organization collects knowledge and archives the lesson learned after each project. The companies could learn from successfully completed projects but also from those that were unsuccessful. We can conclude that the project failed only if the company has not learned anything for future projects. (Kerzner, 2001)

In order to develop the project management maturity, the organization has to change and prioritize its projects, change the scope of projects, plan capacity, adopt unique project methodology, make changes in the organizational structure etc. In this case one of the main tasks is to develop a project office which should ensure the standardization of processes and operations as well as the application of best project management practices that will contribute to achieving better business results.

4. INFLUENCE OF PROJECT OFFICES ON PROJECT MATURITY OF AN ORGANIZATION

The project management approach in manufacturing organizations and the development of the project office is shown on a case of company Dahlia as a part of the Beohemija business system. Throughout this case it is presented how one manufacturing company has introduced a project management approach and what the role of the

PMO is in developing of project maturity of an organization.

Company Dahlia was founded in 1924 in Belgrade. In 2004 the company was privatized and since 2008 it is a part of the Beohemija business system. The company produces a variety of brands including: Dahlia, Brion, Hera, Becollino, Nexill, Dexpantehmol, Whitedent etc.

The organizational structure of the Dahlia company is functional and it is an integral part of the Beohemija business system. Functional managers report to the General Director of Dahlia and to functional managers from Beohemija.

The sector for Strategic Project Management was established in 2010 due to the need to implement the strategy of the company, and this establishment is the result of the top management decision to introduce a project management approach into the company.

The PMO is located within the Development Sector. The name of the PMO is Strategic Project Management and it consists of production projects sectors which are located within Dahlia and the Beohemija factory in Zrenjanin.

When the PMO was established in the organization, the top management defined the objectives and formulated the strategy for achieving the desired goals. Also, they defined the assignments which should be successfully conducted. The role of the PMO was to translate assignments into projects and to introduce the project methodology into business. The initial assignment for the PMO was to introduce the project methodology and all employees who will be responsible for the planned projects to the top management. Introduction and adoption of project methodology is a long process and it leads to changes in the way of thinking on every organizational level.

This methodology is centered on increasing the awareness of employees: they are expected to take into account only and strictly the required assets and the value of the project outcomes and should be focused on the needs of the organization as a whole, not the needs of the individual functional units.

The sector for Strategic Project Management, until now, has mainly dealt with planning and initiating projects, while in the areas of implementation and monitoring it has not been as active as it was in the first two. The organization introduced project methodology, as well as metrics for monitoring successful project implementation. The responsibility of the project leaders is to monitor these metrics and to report to the PMO about the project performance.

The project office has recognized that the primary work is education of employees within the organization in order to develop project culture. In this way, the progressive acceptance of changes by employees and the organization is achieved. Also, the work of employees who are part of the planning and implementation project team is integrated. That also reduces the fear of losing the power and authority due to giving a greater authority to the project manager.

In Dahlia, project methodology is applied in the sector for production projects. The sector of production projects applies project methods and techniques for planning and monitoring of projects. This sector is responsible for planning and coordination of the production of each product.

According to the project maturity model, the company Dahlia is “located” within the second level of project maturity model, namely, the level of common processes. The company has defined metrics and has measured performance of ongoing and delivered projects, so we can conclude that the organization is at the level of common processes. Through education and trainings a project-oriented culture is gradually created. One could say that the organization has recognized the need for project approach, but there is still a fear that project managers could threaten the authority of functional managers.

Top management has identified problems and has formulated a strategy and goals which should resolve identified problems and whose achievement should contribute to the planned projects. The project team and the manager did not participate in the formulation of strategies and projects. That indicates that the project team has a role only in creating a plan for the implementation of projects and monitoring their implementation using the defined metrics. The project team worked

on the construction of infrastructure and systems for monitoring and reporting, but now there is a need to focus attention on people’s education regarding the use of these systems. It can be concluded that the PMO in this company has a supporting role in the implementation of the strategies.

In order to achieve a higher level of project maturity, the main task of the top management is to define a unique project methodology which will be adopted and applied on the level of organization as a whole. First of all, it is necessary to integrate project management with total quality management and simultaneous engineering. However, apart from these integrations, modern business requires integration with risk management and the changes that would result in a more effective and efficient management of the organization.

It is important to emphasize that the development of project culture which needs to be incorporated into the organization as a part of corporate culture plays the key role in the implementation of integrated methodology. In order to build a project culture, the organization has to work on not only formal education but also on training to raise awareness of employees about the benefits that they could have from adopting the project approach. However, the important fact is that all activities focused on building a project culture have to be supported by the top management as well as managers in all hierarchical levels in order to achieve the expected results

The support of the top management in the Dahlia company was a key factor for a successful implementation of project approach and the establishment of the PMO which should ensure an integrated operation of the project and functional managers. The functional managers need to eradicate the old model where each functional manager is concerted on work of their own functional units and the achievement of its target and not targets of the organization as a whole. The foregoing implies that the project and functional managers should work in teams in which functional managers do not feel inferior or feel like their authority is threatened if they are required to report about work on projects to the project managers.

In order to develop a project maturity of Dahlia, the company needs to think about implementing a

project organizational structure. The current organizational structure is functional, which means that the holders of projects are functional managers and project managers have only a supporting role. We, thereby, may recognize the need to implement a project organizational structure which will ensure substantial benefits for the organization. In this way project managers will get formal authority for managing the company projects, and this will also reduce the potential conflict and highlight the importance of project management in achieving strategic goals of the company.

The top management of the Beohemija business system has realized the importance of implementing the project approach in the organization, but there still exists the employee resistance to the acceptance of the project approach. This problem can only be resolved with a strong support from the top management and by granting responsibility and authority to the project managers. Also, the company should strive to see project management not as an operational discipline but as a significant factor of strategy implementation and sustainable growth and development. It is important to note that this is a long process that requires change of the organizational culture and involvement of project managers in the process of formulating the strategy, as someone who has a key role in the implementation of projects which will implement the strategy of the organization and accomplish a vision of its future operations.

5. CONCLUSION

This paper has analyzed the project maturity of the Dahlia manufacturing company. It can be concluded that there is a need to recognize project management as a main tool for achieving strategic objectives. Based on that, it is very important for an organization to successfully implement the project approach and develop a project maturity. Through implementing an integrated project methodology a manufacturing organization can reduce time and costs which are the main critical factors in this industry. In addition, project management approach provides higher quality. But the most important thing is that an organization could use critical resource more efficiently. These benefits are crucial for achieving a competitive advantage.

Organizations should establish the project management offices in order to raise the project maturity on a higher level. The PMO within the manufacturing company has a role to translate production activities into projects and to ensure a successful realization of these projects and to communicate results to senior managers. The highly valued PMO addresses a problem of eliminating and deactivating projects that do not have high value for the organization.

Besides a strategic focus on strategic issues, the PMO should focus on cultural issues. The development and implementation of an integrated project methodology has a key role in developing project culture which needs to be incorporated within an organization as a part of corporate culture. In this paper we described the importance of creating a project culture on the case of the Dahlia company. The PMO has a responsibility to educate the top management and other employees on all organizational levels about project methodology and benefits of its outcomes in order to establish a project culture and increase the level of project maturity. On the one hand it is important to minimize the manager's fear of losing the authority as important as this is to minimize the fear of change. From this we can see that the PMO has to incorporate change management, risk management, concurrent engineering and total quality management in order that the organization should reach the fifth level of project maturity.

In the presented case we showed that insufficient top management support could be a huge barrier for project management maturing. Their sympathy has to be gained due to the fact that they are the most important project stakeholders. Top managers have to give authority to the PMO so that its function can have a purpose. Implementing and improving the PMO has to be viewed as a project with a high priority. That is the only way that an organization can implement an integrated project approach in order to achieve strategic goals and competitive advantage.

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SELECTION OF CONTRACTORS ON A SINGLE PROJECT AND ON A NUMBER OF PROJECTS WITH FIXED DATA ON ACTIVITIES

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Abstract: In a complex project, such as in case of the construction industry, it is necessary to hire more contractors who are specialized in certain works. It is understood that some or all of the papers and reports several potential performers are required. However, the work will be awarded to only one contractor. It is usual that contractors require maximizing the value of work performed, i.e. the amount of appropriate activity costs. The same specificities are present in the integrated planning of several projects. Here we consider two types of problems from the viewpoint of data for action: (1) what is known is the fixed duration of activities with corresponding costs when the duration cannot be shortened, and (2) there are activities with more options for duration and associated costs. Problems (1) when considering costs of contractors are described by multi-criteria models of binary linear programming. For this type of problems in this work we will give a general mathematical formula and illustrations with examples of hypothetical projects. More complex problems (2) have been shown in our other works considering a single project with the criteria for the project duration, project costs and contractor's costs. For this purpose, we need multicriteria models of mixed-integer and binary linear programming.

Key words: single project, multiple projects, fixed time activities, more potential contractors, project duration and costs, contractors costs, optimization, multicriteria mathematical models.

1. INTRODUCTION

A complex project execution is carried out with the participation of more contractors needed as specialists in the relevant works. This is particularly evident in the construction industry. Therefore it raises the problem of choosing the most suitable contractors keeping in mind the objectives of the project. At the same time, contractors can express their own partial interests, which can be set as the criteria and considered equal to the criteria of the project, or to lower priorities. In addition, it is extremely important to introduce priorities to the contractors for their equal treatment.

In accordance with the characteristics of the project activities, two types of multi-criteria problems may occur when selecting the contractors.

The problems (1). Each project activity has a unique/fixed duration with a corresponding cost and this duration cannot be shortened. This defines the duration and cost of the project. The selection of contractors can be done by considering their costs. The problems of this type will be presented in this paper

with the aim to plan individual projects and multiple projects simultaneously.

Problems (2). Some or all of the project activities have several options for duration and associated costs. This case is considered in the literature as Crashing Analysis (Hendrickson, 2008). The starting point is the maximum duration of activity with minimal cost, which determine the maximum duration of the project and the minimal cost of the project. Then an iterative process of shortening the necessary activities is carried out to achieve a shorter project duration with minimum additional project costs. In this way the variants of the project duration and the corresponding optimal costs are determined. The final result is the minimum project duration and an optimal project cost. In addition, all activities on the critical paths are reduced to their minimum time, while others may be partially shortened or retain maximum durations. Important are the two sub problems: minimization of project cost for a given maximum project duration and a minimization of project duration with a given maximum project cost. Times and costs of activities can be considered in two ways.

Firstly, known are only the costs of the maximum and the minimum times. A linear approximation of costs for other permissible times must be calculated. Secondly, the costs of all allowable times should be known.

These problems have been thoroughly considered in cases of planning a single project and maximizing costs for several participants, with the following project criteria and requirements: (a) minimization of project costs for a given project duration (Nikolić and Drobňaković, 2013a), (b) minimization the project time and cost (Nikolić et al., 2013b), (c) minimization of project duration with limited project costs (Nikolić et al., 2013c), and (d) minimization the project time and cost (Nikolić et al., 2013d). Linear approximations of costs of activities are used in (a) and (c), and the known costs in (b) and (d).

Planning of several participants, either on a single project or on several projects, require the application of a multi-criteria optimization. Depending on the characteristics of activities it is necessary to use two types of multi-criteria mathematical models, i.e. models of multi-criteria programming (MCP): (1) binary linear programming models if activities have a fixed time (which will be shown further on), and (2) mixed integer and binary linear programming models if activities have variants of time (presented in the above mentioned papers). It is possible to identify all Pareto-optimal solutions, which is not rational, or only selected Pareto-optimal solutions. A further analysis of such solutions must be performed in order to select one solution for implementation, one that is seen as the most appropriate under given business conditions. On the basis of such a solution, a project plan using standard Project Management software will be created.

2. MATHEMATICAL MODELS (1)

This section presents the modeling of problems with fixed activities time.

2.1. MODEL OF SINGLE PROJECT

$$\max C_j = \sum_{i \in I} c_i h_{ij}, \quad j \in J \dots\dots\dots (1.j)$$

s.t.

$$\sum_{j \in J_i} h_{ij} = 1, \quad i \in N \dots\dots\dots (2)$$

$$h_{ij} = \begin{cases} 1, & \text{if on } A_i \text{ is selected } B_j \\ 0, & \text{otherwise} \end{cases} \dots\dots\dots (3)$$

$$i \in I, \quad j \in J_i$$

when: n – number of project activities A_i , $I = \{1, \dots, n\}$ – set of indices i at A_i with $i \in I$, (t_i, c_i) – duration and cost of A_i , m – number of potential contractors B_j on project with indices $j \in J = \{1, \dots, m\}$, m_i – number of potential contractors B_j to A_i with $j \in J_i \subseteq J$ and $i \in I$, and h_{ij} – binary variables with values of $h_{ij} = 1$ only if A_i is selected on B_j (otherwise $h_{ij} = 0$, A_i is not selected on B_j) with $i \in I$ and $j \in J_i$.

Criterion functions (4.j) are the costs of some or all contractors B_j , $j \in J$. Constraints (2) ensure that for any A_i only one B_j can be chosen. With (3) natural conditions of binary variables are specified.

2.2. MODEL OF SEVERAL PROJECTS

$$\max C_j = \sum_{i \in N_k} \sum_{k \in K} c_{ik} h_{ikj}, \quad j \in J \dots\dots\dots (4.j)$$

s.t.

$$\sum_{j \in J_{ik}} h_{ikj} = 1, \quad i \in N_k, \quad k \in K \dots\dots\dots (5)$$

$$h_{ikj} = \begin{cases} 1, & \text{if on } A_i \text{ at } P_k \text{ is selected } B_j \\ 0, & \text{otherwise} \end{cases} \dots\dots\dots (6)$$

$$i \in I_k, \quad k \in K, \quad j \in J_{ik}$$

wher: p – number of projects P_k , $K = \{1, \dots, p\}$ – set of indices k at P_k with $k \in K$, n_k – number of activities A_{ik} on P_k with $i \in I_k = \{1, \dots, n_k\}$ and $k \in K$, (t_{ik}, c_{ik}) – duration and cost of A_{ik} on P_k , m – number of potential contractors B_j on all projects with $j \in J = \{1, \dots, m\}$, m_{ik} – number of potential B_j on A_{ik} at P_k with $i \in N_k$ and $k \in K$ so that $j \in J_{ik} \subseteq J$, and h_{ikj} – binary variables with values of $h_{ikj} = 1$ only if A_{ik} is selected on B_j (otherwise $h_{ij} = 0$) with $i \in I_k, k \in K, j \in J_{ik}$.

Using (4.j) are maximized costs of contractors B_j , $j \in J$. Conditions (5) defined for any A_{ik} only one B_j . Binary variables h_{ijk} are described in (6).

3. SOLVING OF MODELS MCP

The MCP model in a general case can be solved in two stages using the corresponding models with one criterion. The solution of model MCP in the mathematical sense is X_{eff} - the set of all *Pareto-optimal solutions* or *efficient solutions*. However, in case of real problems it is not easy to determine such a set or it is not necessary. The models with smaller dimensions (the number of criteria, constraints and unknown) can have many Pareto-optimal variables, so they may have a lot of Pareto-optimal solutions. Therefore, it is appropriate to define a narrower subset of such solutions, among which a final solution (**Stage 3**) is selected as the best in the given conditions of business.

Note 1. If model MCP has a solution x^* that gives maximum values C_j^* to all criteria C_j , $j=1, \dots, m$, then x^* is *perfect solution*. The criteria are not conflicting and the problem is solved. Unfortunately, this does not happen frequently to real MCP problems.

Note 2. Any two Pareto-optimal solutions have the characteristics that each of them has a better (higher) value of at least one criterion, and, at the same time, a worse (lower) value for at least one of the remaining criteria.

Note 3. If an observed solution does not have a better value for at least one criterion compared to another solution, then the observed solution is not Pareto-optimal (it is dominated by solutions with which it is compared).

Stage 1. Starting analysis of MCP model (Table 1). Optimizes each criterion separately and independently of other criteria. First, to model with C_1 needs to determine the optimal solution $x^{(1)*}$ and maximum value C_1^* . This solution is called the *marginal optimal solution* of C_1 or the first of *extreme Pareto-optimal solution* of the model MCP (Ehrgott, 2000). C_1^* is called the *ideal value* of C_1 . Then, using $x^{(1)*}$ the values for other criteria are calculated: $C_{1k} = C_k(x^{(1)*})$, $k=2, \dots, m$. These values are called the *consequences of marginal solution* $x^{(1)*}$, ie. *consequences of ideal value* C_1^* . The process continues with C_2 and ends with C_m .

Table 1. Starting analysis of MCP model

		C_1	C_2	...	C_m
$\max C_1$	$x^{(1)*}$	C_1^*	C_{12}	...	C_{1m}
$\max C_2$	$x^{(2)*}$	C_{21}	C_2^*	...	C_{2m}
...
$\max C_m$	$x^{(m)*}$	C_{m1}	C_{m2}	...	C_m^*
Best (max)		C_1^*	C_2^*	...	C_m^*
Lowest (min)		C_1^-	C_2^-	...	C_m^-

Note 4. If some criterion C_j has a multiple marginal solution $x^{(j)*}$, it is necessary to determine the best values C_{jk} of other criteria according to their priorities (see e.g. Nikolić and Borović, 1986).

The *best values* C_j^* of criteria and *lowest values* $C_j^- = \min_s C_{sj}$, $j=1, \dots, m$, determined C_{eff} - the *criterion space* of model MCP. Values C_j^* form the *ideal point* $C^* = [C_1^*, \dots, C_m^*]$. If x^* does not exist, already $x^* \notin X_{eff}$, then $C^* \notin C_{eff}$.

Note 5. One final solution may be selected from a set of marginal solutions or after determining some *new Pareto-optimal solutions*.

Note 6. New Pareto-optimal solutions can be determined only with the values of criteria in the criterion space C_{eff} .

Stage 2. Finding the new Pareto-optimal solutions. The easiest way is to perform the optimization of C_v as one of the most important criteria and a set other criteria C_j to constrain such forms as $C_j \geq C_{0j}$, $j=1, \dots, m$, $j \neq v$ (Method ϵ -Constraints). Borders C_{0j} are required values to C_j with conditions $C_{0j} \in [C_j^-, C_j^*]$. At the same time, C_{0j} cannot have any values in these sets. Among them there are the certain dependencies. Many high values C_{0j} may prevent finding allowable solutions.

Note 7. If with required limits C_{0j} no admissible solution is found, lower limits for criteria C_j with lower priorities must be

introduced, to provide an acceptable solution (it will be Pareto-optimal). And vice versa. If there is an acceptable solution, it may be possible to examine whether higher limits C_{0j} for C_j with a higher priorities to provide a new acceptable and Pareto-optimal solution.

4. ILLUSTRATIVE EXAMPLES

This section presents planning a single project and planning three projects on hypothetical cases. The duration of the phases of the projects is given in months and costs are presented with appropriate monetary units. Competitors on the project are $m=4$ performers $B_j, j \in J = \{1, \dots, 4\}$.

4.1. EXAMPLE OF SINGLE PROJECT

Some consider a project of $n=9$ phase marked $A_i, i \in I = \{1, \dots, 9\}$, in order to be displayed as nodes on a network diagram (ND). All dependences of phases on the diagram arches are of type *Finish to Start*. All required input data of phases are determined on the basis of information about their activities (Table 1.1, Figure 1.1).

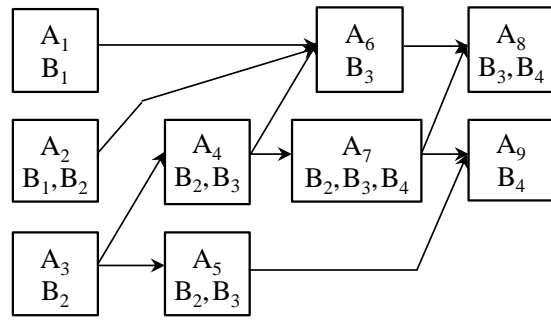


Figure 1.1. ND of project with potential B_j to $A_i, j \in J_i$

Table 1.1. Initial data of phases on project

A_i	t_i	c_i	J_i	h_{ij}
A_1	4	14	{1}	h_{11}
A_2	3	13	{1,2}	h_{21}, h_{22}
A_3	5	15	{2}	h_{32}
A_4	4	14	{2,3}	h_{42}, h_{43}
A_5	4	14	{2,3}	h_{52}, h_{53}
A_6	6	16	{3}	h_{63}
A_7	3	13	{2,3,4}	h_{72}, h_{73}, h_{74}
A_8	4	14	{3,4}	h_{83}, h_{84}
A_9	5	15	{4}	h_{94}
Σ	38	128		

The time analysis determines the project duration $T_p = 19$. It is not important for the selection of contractors, but for forming of the project plan with the adopted solution. The total project cost is $C_p = 128$ and costs C_j of individual contractors $B_j, j = 1, \dots, 4$ may be considered.

Starting analysis. Determine the marginal solutions $x^{(1)*} - x^{(4)*}$ (Table 1.2) and ideals of criteria: $C_1^* = 27, C_2^* = 69, C_3^* = 71$ i $C_4^* = 42$ (Table 1.2). The worst values of criteria are: $C_1^- = 14, C_2^- = 15, C_3^- = 16$ i $C_4^- = 15$. After examining the effects of marginal solutions it is established that there is no perfect solution x^* . It can be seen that each of $x^{(3)*}$ and $x^{(4)*}$ generate two ideal values, for their own criteria and for C_1 . So, these are marginal solutions for C_1 as well.

Table 1.2. Marginal solutions

		$x^{(1)*}$	$x^{(2)*}$	$x^{(3)*}$	$x^{(4)*}$
A _i and chosen B _j with $h_{ij}^* = 1$	A ₁	B ₁	B ₁	B ₁	B ₁
	A ₂	B ₁	B ₂	B ₁	B ₁
	A ₃	B ₂	B ₂	B ₂	B ₂
	A ₄	B ₂	B ₂	B ₃	B ₂
	A ₅	B ₂	B ₂	B ₃	B ₂
	A ₆	B ₃	B ₃	B ₂	B ₃
	A ₇	B ₂	B ₂	B ₂	B ₄
	A ₈	B ₃	B ₃	B ₂	B ₄
	A ₉	B ₄	B ₄	B ₄	B ₄
Number of A _i to B _j	h_1	2	1	2	2
	h_2	4	5	1	3
	h_3	2	2	5	1
	h_4	1	1	1	3

For each $x^{(j)*}$ the number of phases A_i can be calculated, and then awarded to individual contractors B_j are such values $h_j = \sum_i h_{ij}^*, j = 1, \dots, 4$

A further detailed analysis of these solutions, and especially the possible selection of a final

solution, can be appropriately conducted if the percentage realization of ideals C_j^* (Table 1.3.2) is considered. The solution that can be considered to be the best is the one that achieves the highest ideals of criteria. The $x^{(3)*}$ will be selected, if they are acceptable values 21.74% of C_2^* and 35.71% of C_4^* . Or, $x^{(4)*}$ will be adopted if they satisfy 62.32% C_2^* and 22.54% C_3 .

Table 1.3.1. Starting analysis of criteria

		C_1	C_2	C_3	C_4
max C_1	$x^{(1)*}$	27	56	30	15
max C_2	$x^{(2)*}$	<u>14</u>	69	30	<u>15</u>
max C_3	$x^{(3)*}$	27	<u>15</u>	71	15
max C_4	$x^{(4)*}$	27	43	<u>16</u>	42
C_j^*		27	69	71	42
C_j^-		<u>14</u>	<u>15</u>	<u>16</u>	<u>15</u>

Table 1.3.2.

	C_1	C_2	C_3	C_4
max C_1	27	56	30	15
$x^{(1)*}$	100%	81.16%	42.25%	35.71%
max C_2	<u>14</u>	69	30	<u>15</u>
$x^{(2)*}$	51.85%	100%	42.25%	35.71%
max C_3	27	<u>15</u>	71	15
$x^{(3)*}$	100%	21.74%	100%	35.71%
max C_4	27	43	<u>16</u>	42
$x^{(4)*}$	100%	62.32%	22.54%	100%

Note 8. For the selection of a final solution the criteria priorities are of fundamental importance.

It follows that $x^{(3)*}$ is acceptable and the best solution if priority is given to C_1 and C_3 . The solution $x^{(4)*}$ is the best if C_1 and C_4 have the priority. However, if C_1 and C_2 are preferred over C_3 and C_4 , $x^{(1)*}$ or $x^{(2)*}$ will be chosen as the final solution. Now the question arises about priorities between C_1 and C_2 . If they are not the same priorities, a marginal solution for criteria with higher priority will be selected. If they have the same priority, it is necessary to choose $x^{(1)*}$ which achieves C_1^* and 81.16% C_2^* . Less favorable

is $x^{(2)*}$, since in addition to C_2^* it provides only 51.85% C_1^* .

Let us assume that it is not possible to select a final solution on the basis of marginal solutions, and it is necessary to determine some new Pareto-optimal solutions. Following are two illustrations with higher priorities to C_1 and C_2 (Table 1.4).

The new Pareto-optimal solutions. Solution $x^{(5)}$ maximizes C_1 , requesting that C_2 must be received at least $C_{20}=75\% C_2^*$. On phases $i = 1, \dots, 9$ contractors $j = 1, 2, 2, 3, 2, 3, 2, 3, 4$ are chosen. Only 51.85% C_1^* is carried out. It significantly exceeds C_{20} and achieves 81.16% C_2^* . The next $x^{(6)}$ is using a special condition so that the contractor B_2 can be assigned highest $h_{20}=3$ phases A_i . For this purpose an additional constraint $h_{22} + h_{32} + h_{42} + h_{52} + h_{72} \leq 3$ is necessary. Maximization of C_1 gives C_1^* . Further maximization of C_2 , keeping C_1^* with constraint $C_1 \geq C_{10} = C_1^*$, determine the best conditioned value 62.32% C_2^* to C_2 .

Table 1.4.

		$x^{(5)}$	$x^{(6)}$
Required	C_{10}	-	$C_1^* = 27$
	C_{20}	75.00% C_2^* = 51.80	-
	h_{20}	-	3
Achieved	C_1	14 = 51.85% C_1^*	27 = 100% C_1^*
	C_2	55 = 81.16% C_2^*	43 = 62.32% C_2^*
	C_3	44 = 61.97% C_3^*	43 = 60.56% C_3^*
	C_4	15 = 35.71% C_4^*	15 = 35.71% C_4^*

Selection a final solution. A conclusion can be reached that the best is $x^{(6)}$. It gives C_1^* and approximate values for the two criteria: 62,32% C_2^* i 60,56% C_3^* .

Project plan with a final solution. The plan is formed with the assigned stages for contractors (Table 1.6). Software MS Project allows to determine the required elements of

the plan based on a defined project start (Figure 1.2).

Table 1.6. Plans of contractors with $x^{(6)}$

	B_j	A_i	t_i	c_i
Contractors B_j and assigned phases A_i	B_1	A_1	4	14
		A_2	3	13
		Σ	7	27
	B_2	A_3	5	15
		A_4	4	14
		A_5	4	14
		Σ	13	43
	B_3	A_6	6	16
		A_7	3	13
		A_8	4	14
		Σ	14	43
	B_4	A_9	5	15
		Σ	5	15

4.2. EXAMPLE OF THREE PROJECTS

We will consider $p=3$ projects P_k with $m_1=9$, $m_2=8$ and $m_3=7$ phases A_{ik} , respectively $i=1,\dots,m_k$, $k=1,2,3$ (Table 2.1.1).

Table 2.1.1 Initial data of phases A_{ik} on P_k

P_1			P_2			P_3		
A_{i1}	t_{i1}	c_{i1}	A_{i2}	t_{i2}	c_{i2}	A_{i3}	t_{i3}	c_{i3}
A_{11}	4	14	A_{12}	4	14	A_{13}	4	14
A_{21}	3	13	A_{22}	3	13	A_{23}	2	12
A_{31}	5	15	A_{32}	5	15	A_{33}	5	15
A_{41}	4	14	A_{42}	2	12	A_{43}	2	12
A_{51}	4	14	A_{52}	3	13	A_{53}	7	17
A_{61}	6	16	A_{62}	6	16	A_{63}	6	16
A_{71}	3	13	A_{72}	5	15	A_{73}	4	14
A_{81}	4	14	A_{82}	4	14	-	-	-
A_{91}	5	15	-	-	-	-	-	-
Σ	38	128	-	32	112	-	30	100

Dependencies of stages and potential contractors are shown on the next ND (Figure 2.1.1 - 2.1.3). Note that P_1 is considered above in Example 4.1. For mathematical modeling of the problem, the appropriate binary variables will be used (Table 2.1.2).

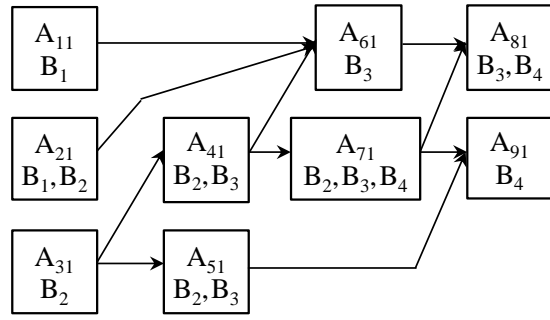


Figure 2.1.1. Project P_1 and B_j , $j \in J_{i1}$

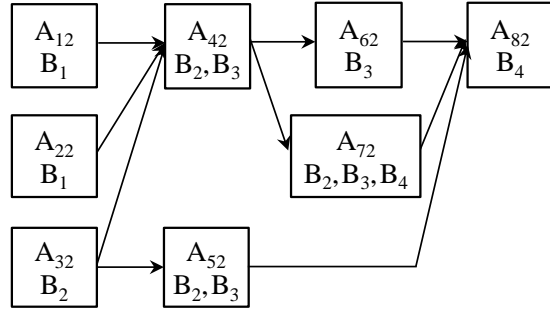


Figure 2.1.2. Project P_2 and B_j , $j \in J_{i2}$

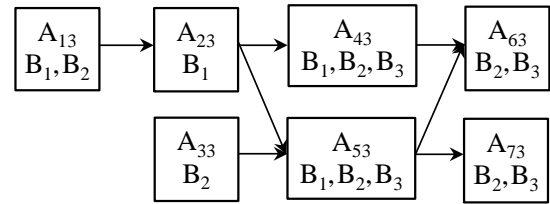


Figure 2.1.3. Project P_3 and B_j , $j \in J_{i3}$

The data t_{ik} on phases A_{ik} determine the durations of projects $T_{p1}=19$, $T_{p2}=17$ and $T_{p3}=20$. Using c_{ik} gives the total cost of all projects which is $C_{pp}=128 + 112 + 100 = 440$. What can still be done is to optimize the costs $C_1 - C_4$ of contractors $B_1 - B_4$.

Starting analysis (Table 2.2). It can be observed that there is no perfect solution. With $x^{(4)*}$ two ideal values are determined: $C_4^*=70$ for its own criterion C_4 and $C_1^*=109$ for C_1 . Other marginal solutions $x^{(1)*} - x^{(3)*}$ achieve the ideals for their own criteria: $C_1^*=109$, $C_2^*=212$ and $C_3^*=186$.

Table 2.1.2. Binary variables h_{ikj}

	P_1	P_2	P_2
A_{ik}	h_{i1j}	h_{i2j}	h_{i3j}
A_{1k}	h_{111}	h_{121}	h_{131}, h_{132}
A_{2k}	h_{211}, h_{212}	h_{221}	h_{231}
A_{3k}	h_{312}	h_{322}	h_{332}
A_{4k}	h_{412}, h_{413}	h_{422}, h_{423}	$h_{431}, h_{432}, h_{433}$
A_{5k}	h_{512}, h_{513}	h_{522}, h_{523}	$h_{531}, h_{532}, h_{533}$
A_{6k}	h_{613}	h_{623}	h_{632}, h_{533}
A_{7k}	$h_{712}, h_{713}, h_{714}$	$h_{722}, h_{723}, h_{724}$	h_{732}, h_{733}
A_{8k}	h_{813}, h_{814}	h_{824}	-
A_{9k}	h_{914}	-	-

Table 2.2. Results of starting analysis

	C_1	C_2	C_3	C_4
$\max C_1$	109	156	46	<u>29</u>
$x^{(1)*}$	100%	73.58%	24.73%	41.43%
$\max C_2$	<u>53</u>	212	46	<u>29</u>
$x^{(2)*}$	48.62%	100%	24.73%	41.43%
$\max C_3$	80	<u>45</u>	186	29
$x^{(3)*}$	73.39%	21.23%	100%	41.43%
$\max C_4$	109	128	<u>32</u>	70
$x^{(4)*}$	100%	60.38%	17.20%	100%
C_j^*	109	212	186	70
C_j^-	<u>53</u>	<u>45</u>	<u>32</u>	<u>29</u>

Let it be considered that the above solutions do not allow the selection of the final solution. Consequently, two new Pareto-optimal solutions are found (Table 2.3).

New Pareto-optimal solutions. First, it examines the possibility that the criteria establish the values that are not lower than the borders $C_{10}=80\% C_1^* \approx 88$, $C_{20}=70\% C_2^* \approx 149$ and $C_{30}=60\% C_3^* \approx 112$. A strict lexicographical order of priorities is assumed concerning the criteria $C_1 \gg C_2 \gg C_3 \gg C_4$. There is no solution to the required limits of the criteria. It is necessary to carry out the progressive optimization of two steps. Bearing in mind that the maximization of C_1 gives $x^{(1)*}$ and

$C_1^*=109$, we start with maximization of C_2 under the condition $C_1 \geq C_{10}=88$. This determines $C_1=92$, $C_2=173$, $C_3=46$ and $C_4=29$. The achieved higher values for C_1 and C_2 than their required values allow us to further maximize C_3 with limits $C_1 \geq C_{10}=88$ and $C_2 \geq C_{20}=143$. It occurs to be the Pareto-optimal solution $x^{(5)}$. The best value for C_3 is $63=33.87\% C_3^*$ and the required initial value C_{30} is achieved with only 53.39%. Priority criteria C_1 and C_2 achieve greater values than their required limits: $C_1=92 > C_{10}=88$ and $C_2=156 > C_{20}=149$. Criterion C_4 has the lowest value $C_4^-=29$.

The next Pareto-optimal solution $x^{(6)}$ is determined by analogy with $x^{(5)}$, examining stricter boundaries: $C_{10}=85\% C_1^* \approx 93$ and $C_{20}=75\% C_2^* \approx 160$. It appears that the best value of C_3 is $46=24.73\% C_3^*$. The preferred criteria have values $C_1=97 > C_{10}=83$ and $C_2=168 > C_{20}=160$. The criterion C_4 , as the lowest preferred, keeps its lowest value $C_4^-=29$.

Table 2.3.

		$x^{(5)}$	$x^{(6)}$
Required	C_{10}	80.00% C_1^* = 87.20	85.00% C_1^* = 92.65
	C_{20}	70.00% C_2^* = 148.40	75.00% C_2^* = 159.40
	C_{30}	60,00% C_3^* = 111,50	-
Achieved	C_1	92 = 84.40% C_1^*	97 = 88.90% C_1^*
	C_2	156 = 73.58% C_2^*	168 79.25% C_2^*
	C_3	63 = 33.87% C_3^*	46 = 24.73% C_3^*
	C_4	29 = 41.43% C_4^*	29 = 41.43% C_4^*

Selection of a final solution. Let's assume that $x^{(6)}$ is the best solution.

Plans of projects with final solution. Plans can be formed from the standpoint of the contractors (Table 2.4). In addition, to each

contractor B_j are determined the values $h_{kj} = \sum_i h_{ikj}^*$ and $h_j = \sum_k h_{kj}$ as numbers of phases A_{ik} on individual projects P_k and the total on all the projects. By using the MS Project software, we determine the project plans, in accordance with the terms set out at their beginnings (Figure 2.2).

Table 2.5. Plans of contractors with $x^{(6)}$

	P_1	P_2	P_3	h_j
B_1	$A_{11},$ A_{21}	$A_{12},$ A_{22}	$A_{13},$ $A_{23},$ A_{53}	h_1 $= \sum h_{k1}$ $= 2+2+3$ $= 7$
	$h_{11}=2$	$h_{21}=2$	$h_{31}=3$	
B_2	$A_{31},$ $A_{41},$ $A_{51},$ A_{71}	$A_{32},$ $A_{42},$ $A_{52},$ A_{72}	$A_{33},$ $A_{43},$ $A_{63},$ A_{73}	h_2 $= \sum h_{k2}$ $= 4+4+4$ $= 12$
	$h_{12}=4$	$h_{22}=4$	$h_{32}=4$	
B_3	$A_{61},$ A_{81}	A_{62}	-	h_3 $= 2+1+0$ $= 3$
	$h_{13}=2$	$h_{23}=1$	$h_{33}=0$	
B_4	A_{91}	A_{82}	-	h_4 $= 2$
	$h_{14}=1$	$h_{24}=1$	$h_{34}=0$	

Note 9. Projects can have the same or different beginnings.

Note 10. In accordance with the resource capacities of the appropriate contractor, a limit may be set to a maximum number of phases (or the total amount of work) in each time unit of projects.

Note 11. When necessary, the conditions may be set for the terms of the beginnings or endings of the given contractors' engagement.

5. CONCLUSION

This paper has discussed the selection of contractors for activities on a single project and on a number of projects. Two classes of problems from the standpoint of data for activities are discussed: (1) known are the unique time of activities that cannot be shortened and the corresponding costs, and (2) there are activities with more options for duration and associated costs. For the same activity a number of performers can apply, but such activity must be assigned to only one contractor. It was pointed out that the class (2)

is exposed in other our works on the examples of single projects. This is considered to be a class (1). Given are general mathematical formulations for the two types of problems as a multi-criteria binary linear programming: (a) selection of contractors on a single project, and (b) selection of contractors on several projects. The maximization of costs of contractors is performed. Next, illustrative examples are presented.

The multi-criteria optimization was applied to determine the characteristic Pareto-optimal solutions. Then, for each problem, a final solution is selected that is considered to be most suitable for the application. With the adopted solutions plans of projects were devised and contractors were selected using the MS Project software. Based on the required beginning of projects specific time schedules for activities and costs are given.

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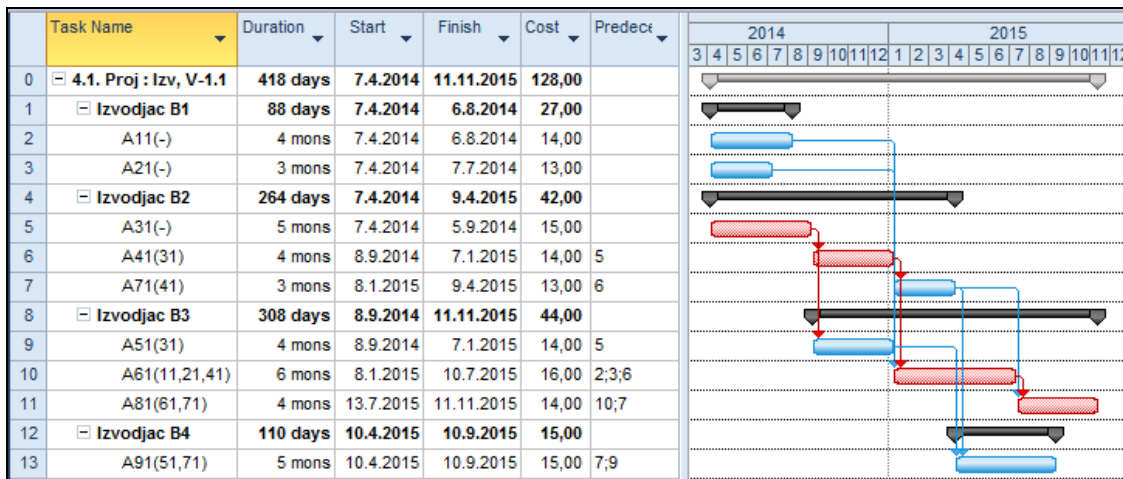


Figure 1.4. Project plan from the point of view of contractors, project start 7.4.2014

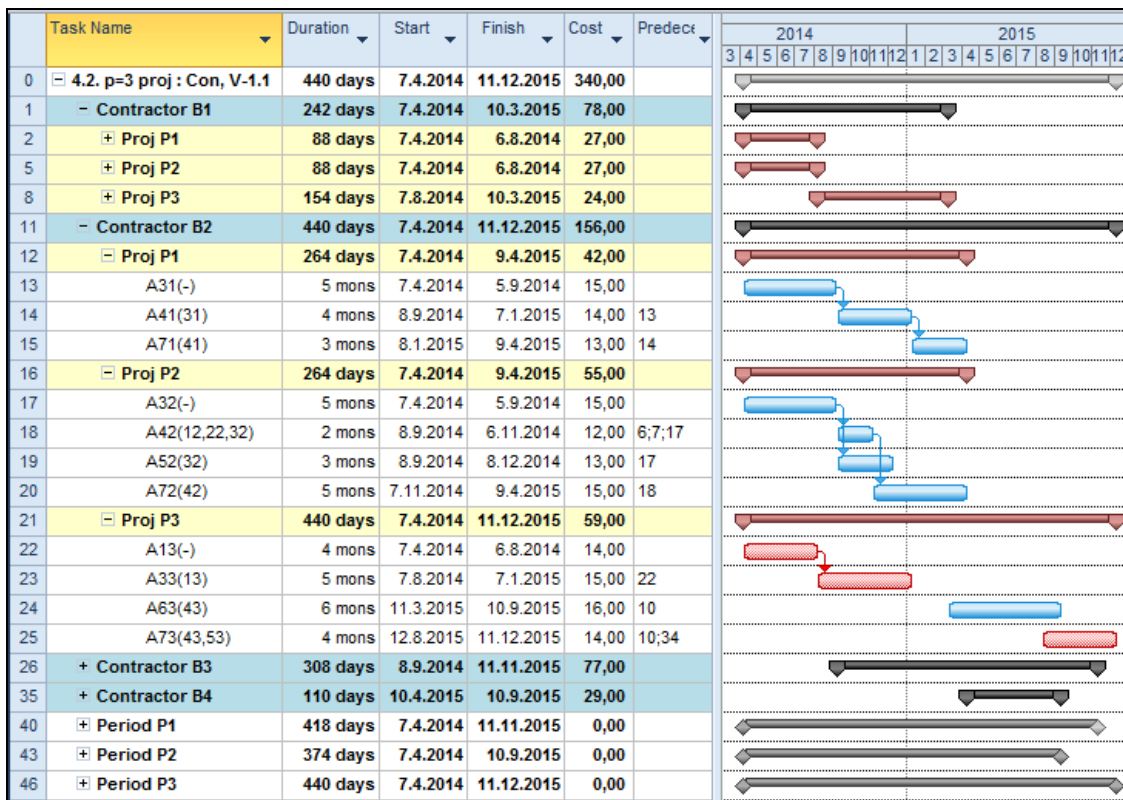


Figure 2.4. Plans of projects from the point of view of contractors, starts of projects 7.4.2014 (hidden phases of B₁, B₃ and B₄)

RISK APPRAISAL FOR SOFTWARE PROJECTS IN ACCORDANCE WITH PROJECT MANAGEMENT MATURITY MODELS

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Abstract: In this study, we analyze the key risk factors for software projects in the context of project management maturity models. Many risks are involved in software development and risk management has become one of the key components in software projects. Risk management of software development projects includes various risk management practices. However, a large number of the present research on software risk analysis focuses on finding the correlation between risk factors and project outcome and project results. Insufficient and ineffective risk and issue management is the key factor for software project failures. To obtain proper and effective risk mitigation and risk control, risk planning should be performed based on risk causality, which can provide more risk information for decision-making.

Key words: Software projects, maturity models, project risks.

1. INTRODUCTION

Between this moment and 2025, the ability of companies and their products, systems and services to compete, adapt and survive will depend to a great and continually increasing extent on the software they will be using (Boehm, 2006). Software project risk appraisal can provide competitive differentiation and quick adaptation to competitive changes for today's products and services. Consequently, risk and risk management are strategic and organizational issues that usually involve a compromise: a risk averse strategy can limit a specific achievement; also, a risk embracing strategy can increase project costs and losses. Trying to set the balance is often underplayed or overlooked in the pursuit of desired goals. At the project level, software projects have long been recognized as high risk ventures to implement organizational strategy. There are two classes of software project risks: generic risks common to all projects, and project specific risks. Some of these risks are easy to identify and manage. Others are less obvious or it is more difficult to predict their impact and resolution. This is related to multiple project dimensions including size, structure, complexity, composition, context, novelty, long planning and execution horizons, and volatile change. Therefore, risk management in software projects is important to: help avoid disasters; avoid rework; focus and balance effort; and stimulate win-win situations. While not all risks have their source in software practices, they all have

the potential to impact the outcome of the software process via the project mechanism through which the software artefact is usually delivered. Risk and risk management are also important because IT projects (including software projects) can be drivers of delivering informational technologies enabled organizational change, so achieving business objectives can be critically dependent upon their success (Bannerman, 2008). However, software success depends on software quality (Gorla & Lin, 2010), effectiveness and completeness (Nienaber & Cloete, 2003). Software quality is frequently determined by the software development process quality (Nienaber & Cloete, 2003), which is defined through specially developed control metric.

2. PROJECT RISK MANAGEMENT PROCESSES

Wang, Dulaimi, & Aguria, (2004) indicated that risk management is a formal and orderly process of systematically identifying, analyzing and responding to risks throughout the lifecycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control. Project risk management implementation would improve project performance through assuring the achievement of project objectives and pursuing opportunities to increase the positive impacts on these objectives. The project risk management process consists of risk management planning, risk identification, qualitative and quantitative

risk analysis, risk response planning, and risk monitoring and control(Hwang, Zhao, & Toh, 2013).

According to the comparison of the risk management process against those standards (see Table 1), it has been found that there are similarities among those given processes, although proportions of essential risk management processes in several standards

are different. Based on the comparative study described in Table 1, common risk management processes can be recognized to include risk management planning, risk identification, risk analysis and assessment, risk response, risk monitoring, and risk management reporting (Grant & Pennypacker, 2006).

Table 1: Risk management processes in accordance with different professional recognition

Risk management process	Professional recognition				
	PMI	OGC	ISO	IRM	HM treasury
Risk management planning	x		x		
Risk identification	x	x	x		x
Risk analysis	x		x		
Risk assessment		x	x	x	x
Risk responses	x	x	x	x	
Risk monitoring	x	x	x	x	
Risk control	x				x
Risk review and reporting			x	x	x

3. METHODS AND TECHNIQUES FOR SOFTWARE RISK APPRAISAL

The main risk effects that were analyzed in the literature for software projects are: budget exceed, time exceed, project stop, poor business performances, inadequate system reliability and stability, low organizational process fitting, low user friendliness, low degree of integration and flexibility, low strategic goals fitting and bad financial/economic performances. The literature was then reviewed to identify the relevant risk factors and to emphasize the key influence factors on software development projects. The traditional management techniques cannot directly capture every kind of uncertainty. These techniques are unable to describe other sources of uncertainty than those elements to which they were originally developed, yet constrained by the information they hold for these elements. For instance, PERT diagrams can only analyze uncertainties about activity duration, cost, and activities that are executed according to predefined conditions.

Uncertainties about developers' motivation, error generation, discovery, and correction rates due to the use of a particular software development method cannot be represented in a conventional activity network (Barros, Werner, & Travassos, 2004).

Each method has its unique advantages and the possibility of applying. Decision trees are simple and easy to understand, while neural networks can capture the non-linear interdependence among variables. Association rules can find rules that can satisfy user specified minimum support and confidence based on (conditional) frequency counting. The regression analysis can establish the dependence between variables and can be used for prediction. Fuzzy logic can aggregate the scores of risk factors into an overall project risk score based on the fuzzy set theory, which is convenient for inexact risk assessment. The clustering analysis groups a set of observations into subsets based on the mutual similarity/dissimilarity of observations, without manually pre-defining specific

categories. Unfortunately, none of these methods and techniques were developed to capture the causality relationships in the form of “A influences B.” These methods may (unintentionally) discover some genuine cause–effect relationships, but they are unable to distinguish causality from correlation (Hu, Zhang, Ngai, Cai, & Liu, 2012). Hu et al., (2013) in their study adopt random forest algorithm which was usually shown to be more accurate than the decision tree. Also, successful projects are regarded as positive samples, whereas the failed ones are regarded as negative samples. A large number of authors use true positive, false positive, true negative and false negative segments to evaluate software project risks according to their business goals and project results.

Also, the commonly used tools for graphical presentations are risk maps. In the studied context, risk maps are employed as part of a wider set of project management technologies. Risk maps are prognostic images in the sense that the dimensions of probability and impact are estimates of potential future events. As other prognostic

representations such as growth curves, series and histograms, risk maps use mathematical–statistical elements, particularly probability values, tabular format and Cartesian coordinate system of x and y axes. At the same time, however, the traffic light qualification can be read as indicating past and current performance of the project.

4. PROJECT SUCCESS AND PROJECT RISK MANAGEMENT APPROACH

Belli et al., (2006), in contrast with the traditional definition of project success, found that project managers saw success in the delivery of a system that met customer requirements at work (resulting in improved quality and personal achievement). In the 26 publications on the relation between risk management and project success that were investigated, the traditional manner of defining and determining project success is still very common. About two third of the publications dealt with in this paper refer to project success in terms of compliance with time limits, cost limits and meeting requirements (see Fig. 1) (de Bakker, Boonstra, & Wortmann, 2010).

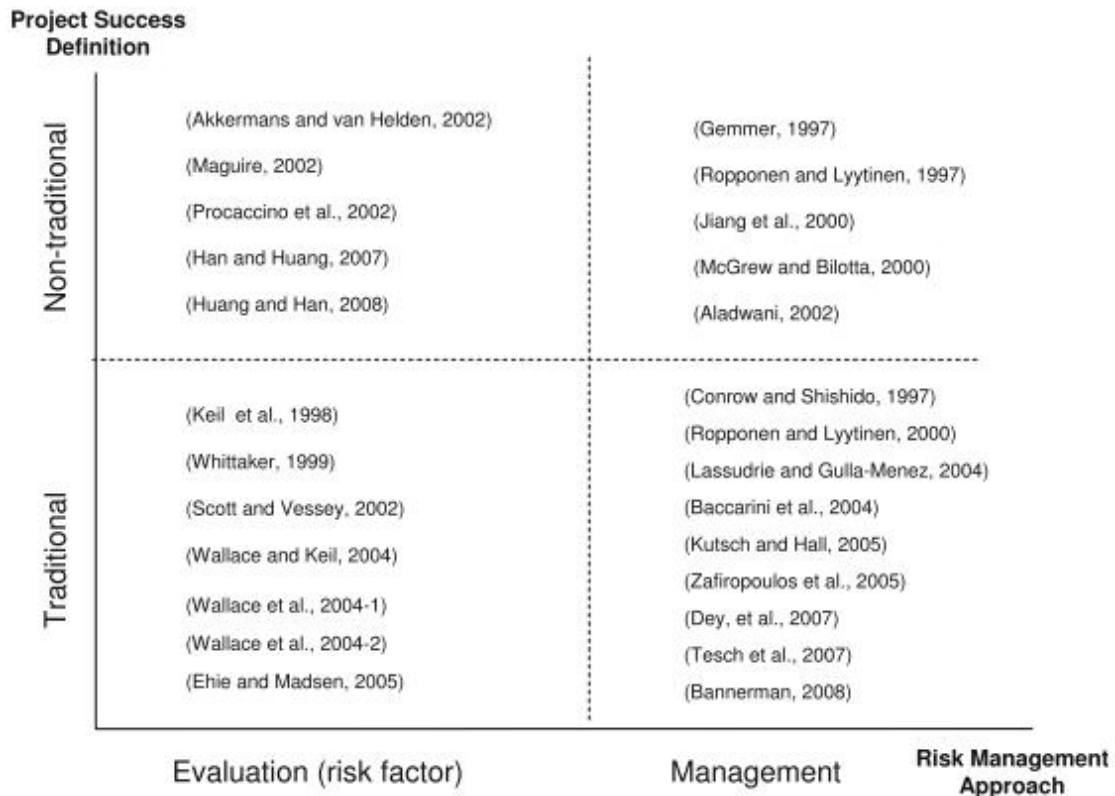


Figure 1. Risk management approach in relation to project success definition (de Bakker et al., 2010)

Agarwal & Rathod, (2006) identified two different perspectives of success: internal, linked to time, cost and scope that emphasized the value of project monitoring and control processes and external, focused on customer satisfaction and system quality. Most research on software project risk analysis focuses on the discovery of correlations between risk factors and project outcomes and results of projects. At present, studies on risk analysis of software projects involve two approaches in network construction: one, experts manually specify the network to reflect expert knowledge; the other, they use data mining algorithms that automatically learn the network from observational data in risk prediction. Conceptually, from the organizational and project perspective, risk arises when organizations pursue opportunities in the face of uncertainty, constrained by capability and cost. The challenge is to find a position on each of these dimensions that, in combination, represents a risk profile that is appropriate to the initiative and acceptable to internal and external stakeholders. For intelligent risk analysis of software projects, many works have used these methods, including regression analysis, association rules, decision trees, fuzzy logic, clustering analysis, and neural networks (Hu et al., 2012). ERP project failure classification includes four levels:

1. *Process failure*, when the project is not completed within the time and budget.
2. *Expectation failure*, when the IT systems do not match user expectations.
3. *Interaction failure*, when users' attitudes towards IT are negative.
4. *Correspondence failure*, when there is no match between IT systems and the planned objectives.

The 19 ERP risk factors are listed below (Aloini, Dulmin, & Mininno, 2007):

1. Inadequate selection
2. Poor project team skills
3. Low top management involvement
4. Ineffective communication system
5. Low key user involvement
6. Inadequate training and instruction
7. Complex architecture and high number of implementation modules
8. Inadequate BPR
9. Bad managerial conduct

10. Ineffective project management techniques
11. Inadequate change management
12. Inadequate legacy system management
13. Ineffective consulting services
14. Poor leadership
15. Inadequate IT system issue
16. Inadequate IT system maintainability
17. Inadequate IT supplier stability and performances
18. Ineffective strategic thinking and planning
19. Inadequate financial management

5. PROJECT MATURITY MODELS AND PROJECT RISK SOFTWARE APPRAISAL

Achieving maturity in project management, the leaders or managers of the organizations should know how to plan and manage projects. Project management is used in many areas including a very limited extent of education and it involves the planning and control of the three variables of time, cost and performance (Blenchard and Cook, 1973). A maturity model provides a systematic framework for carrying out benchmarking and performance improvement (Lianying, Jing, & Xinxing, 2012). Software Engineering Institute (SEI), started to develop a process maturity framework for software development and it resulted in the publication of the Capability Maturity Model with five levels, in 1991. Maturity models have their origin in the field of total quality management (TQM). They drive strategically linked continuous improvement and so require a thorough understanding of an organization's current position and the position of the organization in the future (Brookes and Clark, 2009). It turns out that the Capability Maturity Model is quite robust and has its application beyond software engineering for which it was originally developed. There are two areas of application that it has spawned. They are the People Capability Maturity Model (P-CMM)(Curtis, Hefley, & Miller, 1995), which is a five-level model patterned after the five levels of the Capability Maturity Model, and the Project Management Maturity Model (PMMM) (Demir & Kocabaş, 2010). The Project management maturity model is regarded as a useful tool to

evaluate the organizations' current project management capability. The project management maturity model, as the framework and tool to evaluate the level of organizational project management capability has aroused widespread concern of experts in recent years. In 1987, the Software Engineering Institute (SEI) of Carnegie Mellon University took the lead of proposing the Capability Maturity Model from the standpoint of the software process capabilities (Paulk, Curtis, Chrissis, & Weber, 1993). The model offers five maturity levels for the assessment of the ability of contractors in 18 process areas, 52 objectives and more than 300 key practices, in order to help software companies continually improve their software process capability.

The successful application of the Capability Maturity Model in the software industry inspired the experts internationally from project management fields in the heated research on and the development of the maturity evaluation model of project management. As a result, there have been many valuable project management maturity models since then. Harold established a five-scale project management maturity model, referred to as K-PMMM. The model uses a questionnaire survey method to evaluate the project management level of the enterprise by dividing different scores sections (Kerzner, 2013). The K-PMMM analyzes more deeply the consideration of project management in the establishment of the maturity model, but establishes the maturity model on the level of strategic planning (Peng, 2003). The Project Management Solution Software in the United States integrated the 5 processes proposed by Software Engineers Company (SEI)(Kan, 2002), with the nine knowledge areas of project management put forward by the Project Management Institute (PMI) to produce a comprehensive, easy to accept, and project management maturity improving model called the PMS-PMMM (Guo, Lianying, Jing, & Xinxing, 2012). In comparison with the previous model, the PMS-PMMM is more closely connected to project management, and has a stronger operability. The Berkeley Project Management Process Maturity Model,

shortly the PM2, developed by Young Hoon Kwak et al, not only covers all the nine project management knowledge areas, but also expands beyond them in accordance with the five stages of the project life cycle, and discusses the key processes of each scale in those stages (Kwark and William, 2002). The American Project Management Institute (PMI) proposed the three-dimensional model OPM3, which not only provides a systematic evaluation and improvement method for the enterprise from a single project to entrepreneur portfolio projects, but also for the first time introduces and solidifies the Best Practice in each of the commercial procedures (Simangunsong & Da Silva, 2013). The project management team from the Vienna School of Business Administration Economics has developed a six-dimension project management model from the viewpoint of the self-assessment and benchmarking management of project management, referred to as the Cobweb Model. It is different from the PMMM in that it uses a cobweb model which has six aspects (Turner 2004). The Cobweb model does not adopt the procedures of the traditional maturity model, but has the advantage of a multi-dimensional display of the project management capabilities, visualizing the different sub-processes of project management maturity. Yu proposed a project management maturity evaluation index system for the project tender evaluation based on the Project management maturity, and introduced the grey theory to evaluate them (Lin, Huang, & Burn, 2007). Through the literature review, it is obvious that the use of the current maturity model is often limited to the software project and the industrial engineering project. Furthermore, the combination of evaluation and the whole project management process is not sufficient (Lianying et al., 2012).

In the past decade, there has been an increasing research interest in the maturity of risk management and applicable models for practice, and two issues were addressed for risk management maturity assessment:

1. *Methodology of risk management* - It has been found that although the process oriented management method has been mostly adopted in those risk management maturity

models, there was no particular good example in terms of the use of a system engineering method to deal with the complex situation of risk management.

2. *Contents of risk management maturity* - It has been found that although evaluation oriented risk management maturity models were built up, there was a lack of an in-depth description of risk problems by using a systematic structure with regard to risk management capabilities, maturity factors, and maturity ascension (Jia et al., 2013).

6. RISK MANAGEMENT INFLUENCE ON PROJECT PERFORMANCE

Grant & Pennypacker, (2006) performed a benchmarking study of 126 organizations across 17 different industries. Their results, determined from a web-based survey that studied 42 components of maturity, indicated a median level of project management maturity at level 2 with no significant difference across the industries studied. Most software developers and project managers perceive risk management processes and activities as extra work and expense. Risk

management processes are the first parameter to be removed from the project activities when the project schedule slips. The free-spirited culture in many software development firms is in conflict with the amount of control often required to develop complex software systems in a disciplined way. Many software projects and programs involve multiple entities such as companies, divisions, strategic business units, etc., that may have certain interests. There is often a feeling of disconnection and misunderstandings between software developers and their management team, each believing that the others are out of touch with reality resulting in communication problems and lack of trust. Research shows that 45% of all the causes of delayed software deliverables are related to organizational issues (Kwak & Stoddard, 2004).

Hwang et al., (2013) emphasize risk management implementation index (RMII), which describes the extent of risk management implementation in a company, and can be calculated using the following equation:

$$RMII = \frac{\text{No. of projects with risk management implementation}}{\text{Total no. of projects of a company}} \times 100$$

Hwang et al. (2013) indicate that 40.5% and 40.1% of the projects costing less than \$0.1 million and between \$0.1 million and \$1 million implemented risk management, respectively. For those worth between \$1 million and \$5 million, the proportion was a little higher, reaching 44.6%. (Hwang et al., 2013) indicate that the management teams of larger projects attached more importance to risk management implementation and risk management was implemented in 63.8% of the projects worth more than \$5million. This suggested that the risk management implementation level in small projects was relatively low, and that risk management was more likely to be implemented in the projects with higher costs (Hwang et al., 2013). In terms of quality performance, 41.2% of the companies with the RMII of 50% or more reported that risk management had an impact on quality improvement by 4% to 6% and

none felt risk management had no impact, while 64.7% of the companies with the RMII below 50% revealed that risk management improved quality by only 1% to 3% and 11.8% reported that risk management had no impact (Hwang et al., 2013).

Rabechini & de Carvalho, (2013) analyzed 415 projects at different levels of complexity in different industrial sectors in several states of Brazil. The results demonstrate that adopting project software risk management practices has a significant positive impact on project software success. They also show a positive impact of the presence of a risk manager on project success. Paying attention to uncertainties during the project, making use of the risk management techniques and a deeply understanding of the business environment are critical success factors, demanding attention of project managers and risk managers.

7. CONCLUSION

This paper presents a project software management approach, analyzing key risk factors with different project management maturity models. Although software risk management is a daunting task, organizations that implement effective processes proved to be successful, while those that fail in this effort will be unsuccessful. The nature of software projects creates many risks and issues that must be managed and controlled industriously to avoid the common mistakes of many projects. Protecting the value of a project involves dealing with the uncertainty that will be associated with its delivery. The role of Project Management is to assist in turning uncertain events and efforts into certain outcomes and promises. The perceptions and attitudes towards risk management activities comprise difficult challenges for implementing a risk management strategy. A formal risk management process is recommended to manage complex issues associated with software development projects. Many risk management processes have been created to aid organizations, but integrating the processes into organizations has not been successful. The theoretical aspects of the process must be reconciled with the practical challenges of the organization to implement risk management successfully. An effective risk management process will succeed by changing the organizational culture to motivate the individual.

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INTEREST RATE GAPS AND NET INTEREST INCOME

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Abstract: Measuring and managing the risk of interest rate changes in financial institutions (banks), through repricing gap is directed towards the output of interest rate changes onto the net interest income. Interest rate gap represents the difference between the interest income and the interest expense of a bank. Basically, interest rate gaps measure the gap between the financial value of assets and liabilities that come to maturity or that are revalored in a defined period of time. Interest rate gaps connect interest income to interest rate changes, which are not perfectly correlated (that is why they usually flow in the same direction. Therefore, in the analysis of the interest rate output to net interest income, it is necessary to determine the effect of interest spread (margin) on the current value of the cash flow, i.e. the value of assets and liabilities. In order to determine the output of different conventions embedded into the calculation of interest rate gaps and their relatively limited application, financial derivatives (both explicit and implicit), that is, swaps and simulations are mainly used.

Key words: interest rate gap, net interest income, interest sensitive assets and liabilities, gap calculation, financial derivatives and simulations

1. INTRODUCTION

Interest rate gaps are the simplest interest rate risk measurement in relation to net interest income, which is the main variable for managing assets and liabilities. Interest rate gaps are defined as projected time profiles of difference between assets and liabilities that share the mutual reference interest rate. The gap model connects the interest income to the changes in interest rates. Accordingly, the gap model provides the basic rules for interest rate risk management of a balance sheet. Since these gaps are open, the projected liquidity gaps should also be open and included into interest rate gaps, so that the gap model could be consistent with the changes in the net interest income. Due to deficiencies and limitations of interest rate gaps that primarily depend on different scenarios of annual report (balance sheet) for examining the outcomes of different conventions embedded into the calculation of interest rate gaps, the most widely used method is simulation.

2. INTEREST RATE GAPS

Interest rate gaps are standard measurements of the exposure to interest rate risk, and they appear in two basic forms:

- fixed interest rate gaps, for a given period, as the difference between fixed rates of assets and fixed rate of liabilities and
- variable interest rate gaps, for a given period, as the difference between interest

sensitive assets and interest sensitive liabilities.

Static interest rate gaps (just like liquidity gaps) are the projections of the existing assets and liabilities, while dynamic gaps include new transactions as well. Both of them are finite time profiles, which are the results of the projected balance sheets. The analysis rests on static gaps, since nowadays there is no need to hedge any future transactions. Moreover, static gaps are often updated and include any new transactions within consecutive dates.

Variable interest rate gaps are defined according to variable reference interest rates (1 month Libor, 1 year Libor, or Euro Libor, etc.). They are calculated for a specified management time horizon, but the projections should not exceed the horizon, in order to prevent the projected assets and liabilities from generating unsustainable positions (or extremely big gaps).

A typical time horizon in economic analyses is one month through the management horizon that can be extended to 1 – 3 years, or even much longer (5 years or more). The treasury deals with much shorter time horizons, since it manages daily cash flows and possibly uses short-term hedging.

In this paper, a future period is defined by the initial and final date (t and $t + 1$), where the interest rate gap is calculated from the beginning of the period. The conclusion of

this paper is that an interest rate gap is calculated as the difference between assets and liabilities that either have known fixed rates or are interest rate sensitive (IRS), that is:

- fixed interest rate gap ($t, t + 1$) = fixed assets rate (t) – fixed liabilities rate (t) and
- variable interest rate gap ($t, t + 1$) = Interest rate sensitive assets (t) – interest rate sensitive liabilities (t)

3. CALCULATIONS OF INTEREST RATE GAPS

A precise calculation can be done only when “the real interest rate” has been defined. It is

somewhat easier to calculate fixed rate gaps, since there is no need to define reference interest rates beyond the time horizon. In these circumstances, interest rates related to assets and liabilities remain fixed. It is implicit that interest-free assets and liabilities are not included in interest rate gaps. Figure 1 presents an intersection point for a certain period of the balance sheet, where t represents a date in the future. All known rates beginning with that date are “fixed”, so assets and liabilities in balance sheets can be represented as a point in time or the average time limitation the gap is related to.

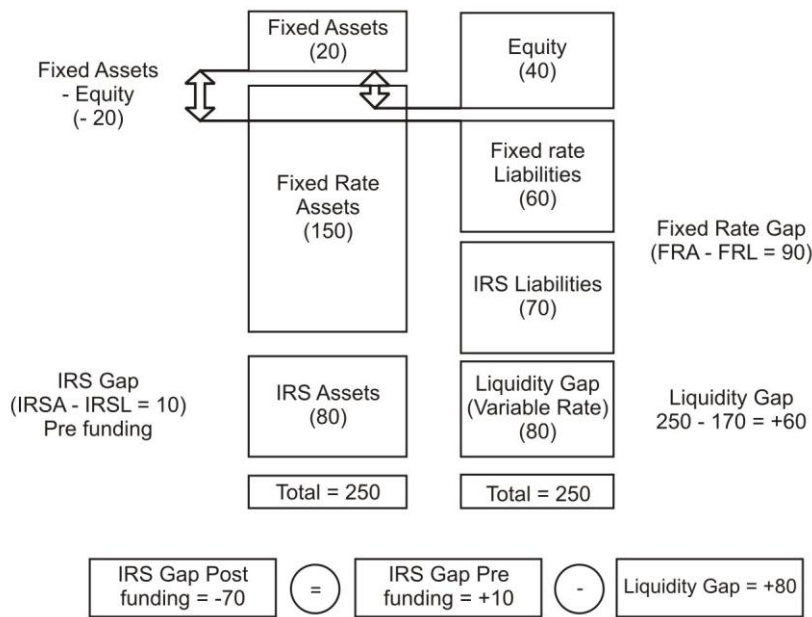


Figure 1. Interest rate gap

4. INTEREST RATE GAP AND LIQUIDITY GAPS

If there is no liquidity gap, the fixed rate gap and the variable rate gap are identical in their absolute values. Consequently, any kind of liquidity gap generates an interest rate gap. Therefore, surplus assets will be invested, and deficits will be funded at a future date, at an unknown rate. Thus, the projected assets deficit is equivalent to interest rate sensitive liabilities, and surplus assets are equivalent to interest rate sensitive assets.

In this paper, it is noticed that variable rate gap changes before and after the deficit, in relation to liquidity gap that is here equivalent to variable assets rate, that is:

- variable rate gap before the liquidity gap = $80 - 70 = +10$ and
- variable rate gap after the liquidity gap = $+10 - 80 = -70$.

Basically, post funding a variable rate gap is the variable rate gap before the liquidity gap minus the liquidity gap, that is:

$$\text{Post funding variable rate gap} = \text{variable rate gap pre funding} - \text{liquidity gap} = -70 = +10 - 80 .$$

Table 1 presents a simplified report submitted by the KBC group banks in the year 2010, which is at the same time the indicator of what banks usually disclose in their annual reports (balance sheets).

Table 1. Sample interest rate gap report

Interest sensitivity of the ALM book (including derivatives), KBC group banks								
In millions of EUR	≤ 1 month	1-3 months	3-12 months	1-5 years	5-10 years	> 10 years	Non-interest-bearing	Total
31.12.2009.								
Assets*	122,036	61,129	132,459	129,444	53,211	18,665	29,212	546,156
Liabilities*	133,087	70,243	128,777	121,596	45,780	14,845	31,829	546,156
Interest sensitivity gap	-11,051	-9,114	3,682	7,848	7,431	3,820	-2,617	0
31.12.2010.								
Assets*	103,677	62,313	90,596	127,750	54,969	22,803	28,574	490,683
Liabilities*	121,298	56,509	86,747	131,423	46,633	17,885	30,187	490,683
Interest sensitivity gap	-17,621	5,804	3,849	-3,673	8,336	4,918	-1,614	0

* Including derivatives

Source: KBC Annual Report 2011. and calculation of author

Internal models can provide more detail, as illustrated in Figure 2, where average assets and liabilities balance sheets are used for each period of time. The horizontal axis x shows the dates, and the calculation is done on a monthly basis or for a shorter time interval. The presented assets and liabilities have fixed interest rates as seen from today. Similar to

liquidity gaps, fixed rate gaps show only the existing assets and liabilities. The upper part shows the assets, and the lower part shows the liabilities, while the difference is offset by a fixed rate gap. Furthermore, Figure 2 presents the projected average rates of the fixed rates of assets and liabilities.

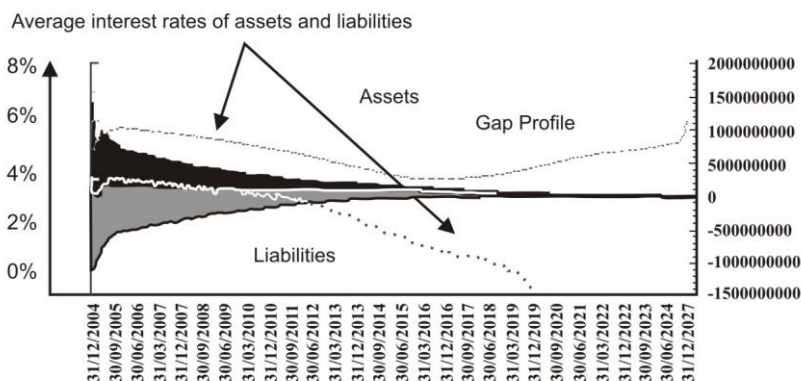


Figure 2. Interest rate risk and dates of flows

5. THE GAP MODEL

Interest rate gaps are very popular, since they measure how sensitive the net interest income (NII) is to rate changes. This phase of the analysis allows us to suppose that all the rates are unknown and that from the running day on they move for the same amount (parallel change).

In the circumstances where a variable rate gap (interest rate sensitive assets minus interest rate sensitive liabilities) is positive, the volume of interest rate sensitive assets is greater than the volume of interest rate sensitive liabilities. If the assets and liabilities have the same index, NII grows along with interest rates, and

vice versa, in the case where the variable rate gap is negative. When the variable rate gap equals zero NII, it is not subject to changes in interest rates. Then it is said that NII is “immune” to interest rate changes. A variable rate gap represents the sensitivity of NII to interest rate change ^[1] (Notations are: • - NII = net interest income, • - IRSA and IRSL are interest rate sensitive assets and liabilities and • - r – interest rate).

A change in the net interest income (NII) due to the change in the interest rate Δr is:

$$\Delta NII = (IRSA - IRSL) \Delta r .$$

Suppose that the variable rate gap is +300. The change in NII in the above example is 2, when the rate changes by 1% or 100 x 1 %.

The basic pattern that connects a variable rate gap and net interest income is as follows:

$$\Delta NII = (IRSA - IRSL) \Delta r = (\text{interest rate gap}) \Delta r.$$

Using a global gap implies that there is only one reference and accordingly, a significant parallel change of all rates. The regulations ask for testing the effects parallel changes have on NII, using 1% or 3% changes. However, since there are several interest rate references, there is the same number of interest rate gaps. Dividing an interest rate gap into gaps by interest rate references makes NII sensitive to these references (for example, interest rates relative to the rates with different maturity dates).

A gap is calculated through a time limit (for example, a month). Every interest rate change calculated according to the gap implies that the beginning of a time limit is taken as the reset date. If the reset date is near the end of the month, the change in interest income or expense would be overrated. The precise calculation of NII is obtained when interest rate gap is zero (reset dates differ), and NII remains sensitive to interest rate changes.

The gap model is very useful since it measures the NII sensitivity to interest rate

changes, but at the same time it provides a solid basis for determining the cost of capital in the interbank market. On the other hand, hedging NII against interest rate risk is very simple, since it implies a gap change, which can be done using hedging instruments (financial derivatives), such as interest rate swaps or forward contracts.

6. NET INTEREST INCOME AND INTEREST RATE GAPS

Table 2 presents the NII for two interest rate scenarios, along with checking the gap model suitability. In order to simplify the calculations, let us start with the assumptions that are not restrictive: constant commercial spread and a change in fixed structure of rates. A simplified balance sheet is projected for the first date – one year from the running date, so there is no need to use a zero date for gap calculations. All subsequent calculations of interest incomes and expenses are done through annual financial statement. Suppose there are no hedging contracts for the following year, and the projected balance sheet is such that interest rate gaps and liquidity gaps are open. We take both of them into account while calculating the interest rate gap, because open liquidity gaps generate the position of interest rate.

Table 2. Balance sheet projections for the banking portfolio

Date	I
Interest rate insensitive assets (a)	38
Interest rate sensitive assets (b)	34
Total assets (c = a + b)	72
Interest rate insensitive resources (d)	30
Interest rate sensitive resources (e)	18
Total liabilities (f = d + e)	48

a) Projected Gaps

The annual projected gap of balance sheet is presented in Table 3. All the gaps are algebraic differences between assets and liabilities. The liquidity gap shows that the

deficit is 24, while the variable rate gap pre funding is +16. The deficit of 24 is calculated as a variable liability rate, unless the rate has been closed beforehand, so the variable rate gap post funding equals -8. ^[2]

Table 3. Gap calculations

Dates	I
Banking portfolio	
Fixed rate assets (a)	38
Interest sensitive assets (b)	34
Total assets (c = a + b)	72
Fixed rate resources (d)	30

Interest sensitive resources (e)	18
Total liabilities (f = d + e)	48
Liquidity gap (c - f) ^a	24
Variable interest rate gap (b - e)	16
Variable interest rate gap after funding (b - e) - (c - f) ^c	-8
Liquidity gap ^b	24
Interest rate gap ^c	8

^a Liquidity gaps are algebraic differences between assets and liabilities.

^b Interest rate gaps are interest sensitive assets minus interest sensitive liabilities, or “variable rate” interest rate gaps.

^c Funding is assumed to be a variable rate before any hedging decision is made.

b) Projected Net Interest Income

The net interest income depends on commercial margins that stand as a connection between reference rates that are used internally and reference rates for clients. Therefore, NII changes depend on the changes in these interest rates and the size of reference rates. Such connections are mostly fixed from the start, and they do not change through the

entire life cycle of assets and liabilities, although reference rates do not have to be identical to market rates. In this case, we suppose that they change along with the market rates. In Table 4, a simple solution has been applied that consists of two scenarios of a flat yield curve, at possible levels of 7 % and 10 %.

Table 4. Interest rate scenarios

Scenarios	Rate (%)
1 (stability)	7
2 (increase)	10

Note: Flat term structure of interest rates

c) Commercial Spreads

Commercial spreads represent a difference between client rates and market rates. They are expressed in the volume percentage of assets and liabilities. Negative commercial margins for liabilities imply that client rates are below market rates.

In this paper, commercial spreads are 2% for assets and -3% for liabilities, which implies that average client rate for assets is 3% above the market rate, i.e. that the client rate for demand and term deposits is, on average, 3% below the market rate. When the market rate is 7%, these rates are 10 % and 4% (the numbers are defined in this way in order to simplify the example. Certainly, real margins differ according to different items of assets and liabilities). In practice, the percentage of margins varies depending on the kind of assets and liabilities, but the calculations are identical. The commercial margin, before closing the liquidity gap, is derived from the client rate and a favourable balance of assets and liabilities of the bank portfolio, as follows:

$$72 \times 10 \% - 48 \times 4 \% = 7,20 - 1,92 = 5,28$$

Bank NII differs from commercial margins, since it is derived after taking into account the cost of funding. The cost of funding is the market rate (plus any credit spread relating to the bank, which is included in the rates scenario). Since the yeald curve is flat, the funding costs do not depend on maturity dates. The NII before funding the liquidity gap represents a commercial NII minus deficit funding costs of 24. This cost is 7 % x 24 = 1,68. Therefore, the bank NII is 5,28 - 1,68 = 3,60.

d) The Sensitivity of NII and Interest Rate Gap

The percentage of commercial spreads remains the same when the interest rate changes, because they are fixed at the beginning of transactions. Therefore, for all the items that are not interest sensitive, client rates do not change when market rates do. For interest sensitive items, a client rate changes along with the market rate due to constant commercial spreads. The NII value after the interest rate change of 7% to 10% stems from

new client rates and should be in accordance with the previously calculated interest rate gap, as presented in Table 5. The values of commercial margins, before and after interest rate growth are 5.28 and 5.76. This change is in accordance with the gap model. The change of commercial margin is 0.48, for the rate

growth of up to 3%. According to the gap model, the change is also equal to the interest rate gap multiplied by the change of the interest rate. The interest rate gap of commercial portfolio is +16, and the change of margin is $16 \times 3\% = 0.48$, in accordance with direct calculation.

Table 5. NII and interest rates

	Volume	Initial rate	Revenues / costs	Final rate	Revenues / costs
Fixed rate assets	38	10 %	3.80	10 %	3.80
Interest sensitive assets	34	10 %	3.40	13 %	4.42
Revenues			7.20		8.22
Fixed rate resources	30	4 %	1.20	4 %	1.20
Interest sensitive resources	18	4 %	0.72	7 %	1.26
Costs			1.92		2.46
Commercial NII			5.28		5.76
Liquidity gap	24	7 %	1.68	10 %	2.40
Net interest income			3.60		3.36

After funding costs, the NII drops by $3,60 - 3,36 = -0,24$, because the funding costs of liquidity gap are indexed in the market rates and increase by $24 \times 3\% = 0.72$. A commercial margin growth of 0.48, minus growth of funding costs, yields a change of -0.24. Alternatively, post funding interest gap is only the commercial portfolio minus the funding amount, or $+16 - 24 = -8$. This gap, multiplied by 3%, also yields a margin change of -0.24.

Static gaps are important for the needs of hedging, since they influence the NII sensitivity to reference interest rates. When new transactions pile upon the existing assets and liabilities, static gaps are updated and the hedges can be adjusted. Hedging is done by applying derivatives for controlling the size and appearance of interest rate gaps. If we suppose that there is a positive interest rate gap change that exceeds the limit, it indicates that there is a surplus of variable rates of assets in comparison to the variable rates of liabilities. The surplus can be offset by a contract that generates income from the fixed rates, rather than income from the variable rates. An adequate instrument for this is the interest rate swap, and the very exchange implies obtaining a fixed rate and paying a variable rate.

7. LIMITATIONS OF INTEREST RATE GAPS

There are several limitations concerning interest rate gaps.^[2] Yet, gap reports remain the same, and the regulations stipulate the monitoring of gaps and specification of all the assumptions that calculations rest upon.

a) Embedded Options in Banking Products

Most serious gap limitations exist due to the options embedded in bank products, like explicit options, i.e. loans with a fluctuating rate that have a cap interest provision paid by the client. Other kinds of options are implicit. They give opportunity to the client, project manager and others to negotiate about fixed rates for their loans when interest rates drop. In this case, a bank can impose a fine for altering the terms of crediting, although many banks observe the clients' demands, because they are not willing to give up other products they sell to their clients.

Embedded options, whether explicit or implicit, change the nature of interest rates.^[3] For example, if the rate of a cap option used to be variable, it now becomes fixed, and during the renewed negotiations about fixed loan rate, the rate is initially fixed, and then becomes variable. Since interest rate gaps rest upon the very nature of interest rates, that is, turning variable rates into the fixed ones, or vice versa, there is always a need to examine and define optional risk.

b) Mapping Interest Rates to Selected Risk Factors

It has to be stressed that banks usually define specific points along the yield curve, or the risk factors. All rates that do not coincide with the chosen reference interest rates correlate with them, but not to perfection. By choosing a small number of interest rates, mapping of all the items of a balance sheet can be defined in relation to them. The very process creates the basic risk, or the remaining risk, due to the difference between the chosen and real rates. One of the solutions is to make real rates (by the product segment) relate to the chosen reference rates, and to use the sensitivity to the calculation of 'standardised gaps'.^[4] Statistical techniques provide that the average yield rate for sub-portfolio (for a range of products) is the ratio of interest income (or expense) in relation to the final debit in the balance sheet. It is feasible even to create time spans of average rates, which enable the connection between the average rate of portfolio and the selection of the chosen rates. The linear dependence can be explained as follows:

$$\text{rate} = \beta_0 + \beta_1 \text{index}_1 + \varepsilon,$$

where: β_1 represents the the coefficient of sensitivity rate of the credit portfolio in view of index x_1 . The remainder ε is a random deviation between the real data and the embedded model. The 1% variation of the market index generates a change in the credit portfolio rate for $\beta_1 \times 1\%$. It shows the basic risk, except for the remainder of error.

A standardised gap defines assets and liabilities according to their sensitivity to the chosen reference rates. For example, if the yield of a credit part has the sensitivity of 0.8, in view of the short term market rate, 0.8 will be measured in the gap calculation.

The alternative solution is to directly use reference rates from the contract on the level of individual transactions. Software manufacturers dedicated to the management of assets and liabilities, provide opportunities to calculate the exact reset dates with multiple reference rates, all until banks own information.

c) Regulated Rates

The same methodology is applied for regulated rates (that are not market rates). In

European countries, it is the rate of regulated saving deposit that represents a linear function of the inflation rate and the short term quarterly rate. Such liabilities are divided into two parts, where one part is Libor indexed, and the other one is inflation indexed. Since there is a sensitivity to inflation rate, inflation indexed hedges are used, because they usually stem from the government bonds that are inflation indexed. Such techniques do not solve the problem completely, insomuch as the defined rates gradually move, i.e. only when the composite index moves by at least 0.5%.

d) Mark-ups and Mark-downs over Reference Rates

The simplest interest rate gaps imply that the variable rate of assets and liabilities has rates that follow the indexes chosen for modeling NII changes using gaps. Mapping percentage in relation to the market rates changes in the same way as the rates for new transactions. When ALM (asset-liability management) is being used to fill the budget, the projections of new transactions are necessary to project balance sheet and NII. Gaps and projections of the NII use commercial margins as investment funds.

e) Intermediate Flows and NII Calculations

Periodical gaps generate irregularities in the NII calculation. The gap model does not date the flows precisely within a time interval. The gap model does not include the effect of reinvestment or cash flows during the period. In some cases, both estimates can significantly influence the NII. In reality, there are different reset dates for liquidity flows and for interest rates. They generate interest income and expense that are not adequately valued in the relation between a gap and the NII.

Figure 3 presents the way revenues and expenses stemming from mid-term reinvestments and loans depend on the length of the time elapsed between the flow date and the final horizon.

The reset date at the end of the period has a negligible influence on the current margin. In the opposite case, when a reset happens at the beginning of the period, it can significantly influence the margin. For example, suppose

that the 100,000 flow happens at the beginning of the period and another 100,000 flow with the opposite sign, happens at the end of the period. These flows are indexed in current rates that are variable. The periodical gap of variable rate will equal zero during the

entire period. Nevertheless, the NII of that period will be interest sensitive, since the first flow generates interest income throughout the period, and it does not correlate to the minor interest expense of the other flow, as presented in Figure 4.

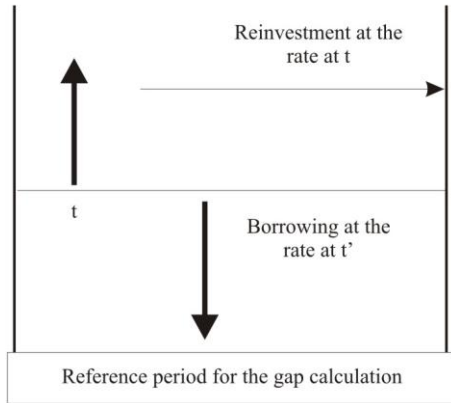


Figure 3. Interest rate risk and dates of flows

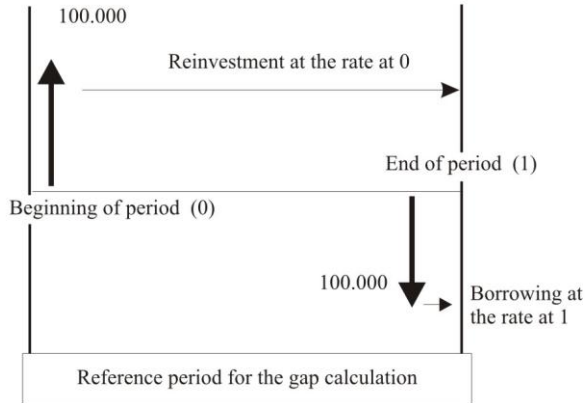


Figure 4. Zero gap interest sensitive margin

Figure 5 presents the error when the ultimate objective is immunisation of interest margin. The gap is different from zero, but the interest margin is immune to interest rate changes. The gap is negative, which implies that NII has to be increased if interest rates drop, for example, from 10% to 8%. Yet, it ignores the reinvestment of a positive middle flow for the

period of 91 days at a lower rate for 289 days. On the other hand, a negative flow generates debt that costs less in the remaining 180 days. Since the NII is interest rate sensitive, we can calculate interest incomes and expenses using the exact flow dates. Interest incomes and expenses are:

$$\begin{aligned} \text{Inflow for 91 days: } & 100,000 \times (1.10^{269/360} - 1.08^{269/360}) = -1,468.00 \text{ and} \\ \text{Outflow for 182 days: } & -153,600 \times (1.10^{182/360} - 1.08^{182/360}) = +1,468.00 . \end{aligned}$$

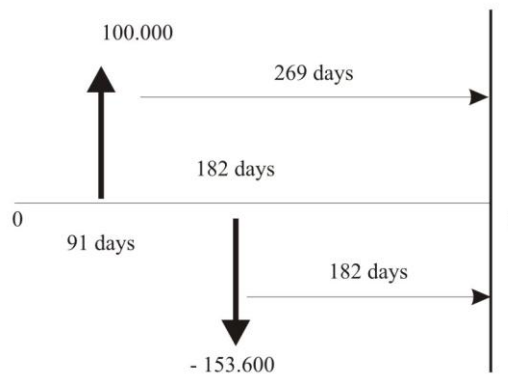


Figure 5. Negative gap and fixed NII

The obtained results exactly correspond, because interest incomes and expenses are proportional to the size of flows and to the remaining period of reinvestment and funding. The first flow is smaller than the second, but it generates interest incomes during a longer period of time. The calculation shows that errors are possible with gaps. In the first case,

the NII is interest sensitive, which is not in accordance with the gap of zero. In the second example, the gap model suggests that the second flow of 53,600 should be included in order to hedge NII, but this procedure would put the margin at risk. The exact condition under which the margin is not interest rate sensitive is relatively easy to get for any set of

flows and it differs from the rules for the gap of zero. This condition uses the concept of duration,^[5] that is, risk management of a balance sheet economic value.

8. CONCLUSION

Changes in interest rates through a balance gap do not affect the net interest income if the bank owns the same amount of interest sensitive assets and liabilities. Still, if the bank owns a greater amount of interest sensitive assets and liabilities, its balance gap is positive and it is exposed to the risk of decreasing interest rate in the market (NII decreases more than contract obligations), so NII decreases. Reversely, when interest rates increase, the return on assets increase more than the return on liabilities, so the NII grows. When the balance gap is negative, the NII decreases.

Due to the fact that gaps have many limitations, it is necessary to use simulations. Simulations project a balance sheet for the future dates under different scenarios. They are also used to include different interest rate scenarios. The NII calculation should also include the effect of options and delays between time points of gaps and real dates for beginning the calculation of interest incomes and expenses. Simulations cannot solve all the problems, but the balance sheet changes according to the client's behaviour. For example, if the rates do not decrease significantly under the fixed credit rate, the clients will not initiate renewed contracting of

rates. This opens the door to using behavioural models when making decisions for the clients. Furthermore, the uncertainty of debiting the projected assets and liabilities creates a "business risk" that is combined with the interest rate risk. Therefore, certain methodology should be defined in order to solve the double uncertainty.

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PROJECT FINANCING IN SERBIA

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Abstract: The purpose of the paper is to point out the characteristics of the mutual business enterprise of a financial institution and investor, through specific sorts of credit placement in the project financing. The project financing is different from the classic credit financing by many characteristics. The basic difference relates to the fact that the return of invested funds is expected from the project monetary inflow and not from the debtor. So, the project income and cash flow are the only guarantee for the investors and financiers for the return of the invested capital. Only a successful project may guarantee a cost-effective investment. Such a concept of project financing means a separation of project from the mother company and defining a special entity – a legal person. In that sense, this paper consists of a thesis with the premises in the theoretical propositions, which are relevant for the justification of project financing implementation. The stress is put on specific characteristics of this project financing model, as the expression of a solution to the insufficient investment issue. The genesis of project financing implementation refers to its significance for the economic development through the history. The technique used in building this model of financing of major projects has positive implications in the field of the living standard of the population.

Key words: project, project financing, economic entity – legal person, project sponsor.

1. INTRODUCTION

Project financing is a very favorable technique which is applied in the major and capital demanding infrastructure and industrial projects, and is successfully used both in developed and developing countries. Project financing is a modern banking product for the economy. The new concept of financing originated at the moment when the conservative banking in the global world economy was abandoned. The term project financing is used to denote a wide scope of financial structures, which relate to the project performances. The concept of project financing has a structure that is suitable for the projects which are long-term, complex and financially demanding. The requirement is that the project may be structured in such a way as to provide both a market justification

and sustainability. The paper refers to project financing in Serbia. In order to review the set issue, to begin with, the concept of project financing is defined and then the rudimentary presumptions for structuring of this model are provided. The postulates which are important for looking into the concept are presented and refer to the distribution of risk to all project participants up to the acceptable level and to the direct link between the project cash flow and investment returns. Therefore, the project financing constitutes a new possibility for a later realization of investment projects.

2. DEFINITION OF PROJECT FINANCING

The getting familiar with this concept begins with the explanation, *what is the project financing?*

Definition:

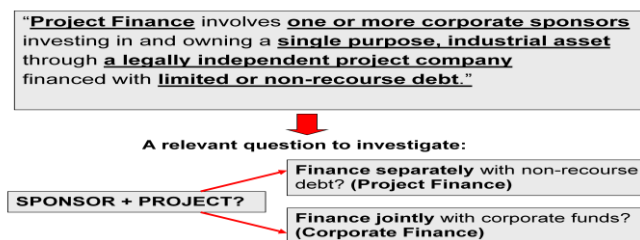


Figure 1: Project financing [1]

Related Definitions:

- Cash Flow
- Off – Balance – Sheet Financing
- Reallocating Free Cash Flow
- Non – Recourse Vehicle /Entity
- Combination Bond
- Infrastructure
- Non – Recourse project debt
- Project Valuation
- Analyzing project Viability
- Build – Operate – Transfer Contract
- Scope.

According to the authors Campbell R. Harvey, Aditya Agarwal and Sandeep Kaul (*Duke University*), the structure project financing highlights [10]:

- Highly concentrated equity and debt ownership:
 - One to three equity sponsors.
 - Syndicate of banks and/or financial institutions that provide credit.
 - Governing Board comprised of mainly affiliated directors from sponsoring firms.
- Extremely high debt levels:
 - Mean debt of 70% and as high as nearly 100%.
 - Balance of capital provided by sponsors in the form of equity or quasi equity (subordinated debt).
 - Debt is non-recourse to the sponsors.
 - Debt service depends exclusively on project revenues.
 - Has higher spreads than corporate debt.
- Independent, single purpose company formed to build and operate the project.
- Extensive contracting.

Major characteristics: Economically and legally independent project company [10]:

- Founded extensively on a series of legal contracts that unite parties from input suppliers to output purchaser;
- Project assets/liabilities, cash flows, and contracts are separated from those of the

sponsors, conditional on what accounting rules permit;

- Investors and creditors have a clear claim on project assets and cash flows, independent from sponsors' financial condition;
- Debt is either limited (via completion guarantees) or non-recourse to the sponsors.

Professor Hoffman of *Cambridge University* states that the term *project financing* is generally used for financing without right to recourse or with a partial recourse and represents such a structure in which own capital and debt are combined for the purpose of construction, use and refinancing of some capital-intensive object, where lenders base the credit approval on the planned income from the use of property, including all the contracts that produce the income and other cash flow.

According to the above-stated, it may be said that project financing is a financial modality where the lenders lean on the project cash flows as the source of debt repayment and on project property as a security for this. Also, we cannot neglect the fact that quantitative methodologies support project financing and include simulation and techniques of financial engineering. They optimize the capital structure and validate the financial variability of project in the risky circumstances, particularly when the project realization is followed by a system risk, risk of potential bankruptcy and economic crisis, as well as by all other limitations, which occur as a consequence of the capital deficit.

3. HISTORY

Project financing is not a new technique of financing. The ancient Greeks used to lend money to merchants for overseas trips, by which they have equipped their ships and provided merchandise for trade. There are many examples. One of them date to the year 1299 A.D., when the English Crown has agreed on a loan from Frescobaldi, the leading Italian banker from that period, to develop a silver mine in Devon. Such arrangement is nowadays recognized as project financing. This is also the example of affirmation of the basic principle of this model of financing because the loan was repaid through the mine

exploitation. There was no discontinuity of project financing in the historic prospective. On the contrary, its application was particularly present in the development of road infrastructure in England, which was renewed in the 18th and at the beginning of 19th century by private capital, on the basis of tolls. The railways, waterworks, gas pipelines, electrical networks and telephony were developed towards the end of the 19th century mostly by investments from the private sector. The major projects, such as Suez Canal and the Trans-Siberian railway, were developed in the 19th century by private capital.

After the First World War, the role of private capital in financing of major infrastructure projects has weakened, and the state started to play the dominant role. After the Second World War, the majority of infrastructure projects in industrial countries were carried out under the supervision of state and were financed from the budget or by multilateral loans. The important role was that of the multilateral financial institutions such as the World Bank, the IMF and the International Bank for Reconstruction and Development. The private capital has returned to the infrastructure projects during last 20 years. The mutual influence of a large number of factors in the early 80s led to the searching for alternative ways of financing infrastructure projects all over the world. One of the recent examples is the development of Euro Disneyland in Paris, which is the unique park of that sort in Europe. Actually, project financing is not anything new in the world of financial services. It has always been an instrument for financing short-term and long-term needs for capital in the range of several million USD to several billion USD.

The accelerating factors of project financing development are:

- Economic growth as well as the growth of population (it causes the need for additional infrastructure objects);
- The debt crisis in many countries became most apparent in the sector of investments (the consequence is that many developing countries have entered the phase of high indebtedness);
- The leading international construction companies looked for new challenges;
- The competition between the main suppliers and operators at the world market resulted in them becoming the chief promoters of projects.

For the above reasons, many initiated projects from that period, were not fully implemented due to the lack of capital. In such conditions, the new modalities of financing of projects are appearing, known under the name of *project financing*.

4. PRESUMPTIONS OF PROJECT FINANCING

The key factors of project financing include their *sponsors and financiers* (lenders). The *sponsors* are the job carriers and they include major multinational companies and other economic sector entities, the government of some country, local authority entities, future buyers of the project output. The *project financiers* are mostly the financial institutions (banks and bank consortia, then international organizations for development financing, investment funds, contractors, buyers of project products and services).

Therefore, the most important participants in the concept of project financing are: project sponsors, financiers (lenders), project company (Special Purpose Vehicle, SPV), contractors, suppliers, operators, financial company, government of the country where the project is performed, financial advisors, technical expert and consulting companies, legal advisors, insurance companies, credit rating agencies, multilateral agencies. According to Finnerty, J., the illustration of complexity of concept of project financing looks like this (figure 2):

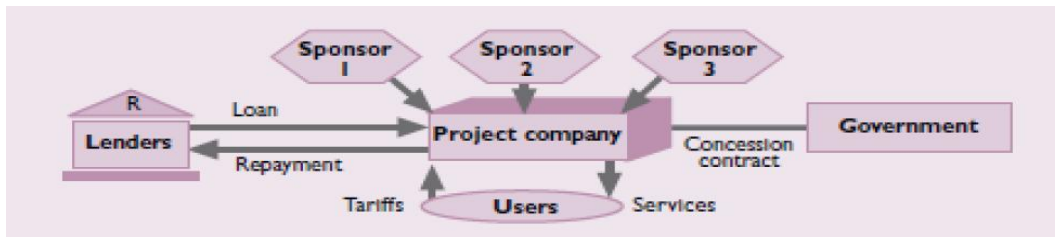


Figure 2: Complexity of project financing [3]

Project financing is constructed on the set of contracts, which define business and financial relations between various parties in the project. Usually, the project companies have to repay the debt after the loan contract expiry. The legal significance of the project financing is linking cash flow and investment return with the establishment of an independent entity.

Therefore, project financing presumes the following activities:

1. Conclusion of an agreement on credit/loan;
2. Establishment of special purpose company for the realization of a particular project;
3. Financing from the economic entity capital;
4. Conclusion of various supportive commercial agreements etc.

For the studying of project financing, the corporate tools available to company managers are used. Such tools are relevant for making the decisions that influence the value of the company and without them the performance of managerial functions would not be possible. These tools are:

- Analysis of present net value.
- Selection of capital structure.
- Selection of dividend policy.
- Negotiations on loan agreements.
- Collections of funds.
- Solution of financial stress when payment of capital amount and interest becomes impossible.

The analysis of discounted cash – flows has the main role in determining the expected profitability of the project. Potential participants in project financing will carefully analyze projections (cash flow statement, sources-and-uses and of-funds-statement, analysis of the present value and so on) before they invest their funds.

The protection of own property enables the project carriers to undertake higher risks in the realization of the complex structure of

projects. The mutual interests, confirmed by firm contracts, based on financial engineering secure the risk distribution and a relative predictability of market movements (price and demand), and therefore the income from the project.

The reasons for the establishment of an independent economic entity – legal person, are the following:

1) *Securitization*: project companies (SPVs) are frequently used for securing the loan.

2) *Risk distribution*: the legal way to isolate high risk projects from the mother company and to divide the risk between the investors – job carriers;

3) *Competition purposes*: for instance, when companies establish a special purpose entity in order to transfer particular intellectual technology and suppress the competitors in that way.

4) *Financial engineering*: the purpose is to avoid the tax or manipulation with financial reports, because it enables the investment banks and other financial institutions to create the securities in accordance with the investors' demands; it is a new creative implementation of financial technology.

5) *Regulatory reasons*: the project company may be established within a separate structure in order to avoid some regulatory limitations in relation with the ownership of a particular fixed property.

A response to the question of why project financing represents an alternative to the classic financing of investment projects would be that project financing is more cost effective because it provides a higher financial leverage and tax shield in comparison with the direct way of financing.

5. PROJECT FINANCING IN SERBIA

The host country in which the funds are invested provides the basic guarantees for a regular servicing of obligations to the

creditors and other investors from the country and abroad. It is also obliged to adopt the appropriate regulations, which are meant to enable the implementation of requirements from the guarantee. The "Law on Foreign Investments" enabled the implementation of *project financing* in Serbia during the 90s of the last century.

With the development of market economy, it is possible to distinguish three models of financing for construction, maintenance and use of infrastructure facilities:

1. Public (state) funding
2. Private financing
3. Mixed partnership between the public and the private sectors.

According to the Basel regulations [2], the special financing of legal persons is divided into project financing and IPRE (Income Producing Real Estate). In our practice, the special financing means the project financing of entities, which are registered as Legal persons. The most recent "Law on public-private partnership and concessions" (ZJPPK) foresees that for the realization of public-private partnership model realization the technique of project financing is used, as well as inclusion of concession to the project company – newly established company of special purpose (SPV – Special Purpose Vehicle).

In accordance with the modern tendencies in the banking development, the banks in Serbia have widened the range of their services, which incorporated not only the conventional segments, such as the role of creditor, but also the sublimation of owner and financial manager. So, the banks have included the jobs of financial engineering in our market. The faster development of the real estate market and the increase in the number of investors in Serbia revealed the need for an offer of a form of financing which is not based on the history of financial reports of the company nor on conservative instruments of collaterals, but the acceptability of an investment is estimated on the basis of the analysis of the project itself. Also, the legal framework for the implementation of a new form of financing – project financing has been created. The *Law on Mortgage* introduced the concept of mortgage on object under construction and the *National Bank of Serbia* introduced, in

addition to the already existing, the classification of claims on the basis of plans of the project cash flow. Designing project financing in our banking market appeared for the first time in 2004, as a form of financing housing construction.

Thanks to the adopted laws, the property-legal framework was created in Serbia for:

- a) objects in the ownership of the special purpose legal persons, established for the needs of project financing and
- b) objects in the ownership of the investors – mortgage.

From the point of view of the purpose of the object and repayment of funds, this model of financing of projects is in compliance with the Serbian development intentions for the construction of objects by investors for the purpose of further sale or exploitation.

There are two directions in development of project financing in Serbia, as follows:

- a) project financing in construction industry and
- b) project financing of infrastructure and industrial projects.

Project financing in the construction industry found its affirmation in recent years. On the Serbian banking market, one of the first offers of loans to legal persons for construction affairs concept for project funding is primarily designed for financing the construction of residential and business facilities for the further sale or renting, then financing purchase of land. There is an estimation that in the following years 30.000 apartments should be built for the purpose of solving the housing issues and reducing the price of square meter in entire Serbia. Serbia has foreseen many locations suitable for the implementation of this modality of financing. Investors have at their disposal "good" locations for construction of "marketable" objects, by the sale of which they can recover the invested capital and earn profits. The services of project financing have been introduced so far by several domestic banks, considering it is a safe placement guaranteed by a high-quality collateral – mortgage. Some significant construction projects were realized through the implementation of project financing: *Trade center UŠĆE* – Belgrade and *HIPO*

model Residential – communal complex Belville in New Belgrade, etc.

The project financing of infrastructure and industrial projects has not really become a reality, there were several attempts of implementation but due to the effect of various factors, some projects were not realized. However, the project of construction

of part of the gas pipeline through Serbia is defined and its implementation has started. It shall be realized by modalities of project financing and crediting of mutual company of a corporate type, *South stream Serbia*. The route of the *South stream* is presented in Figure 3.



Figure 3: The rout of *South stream* [12]

The *South stream* gas pipeline has a strategic significance, both for Russia and for the European Union. The works on the pipeline started in December 2012. The gas pipeline started from the southern part of Russia, from the city of Anapa in Krasnodar Krai. The *South stream* project is very important, not only for the economic development of Serbia, but for the whole region. The gas supply of Serbia becomes secure and safe by this project. Besides, there are other benefits, which are reflected in a more favorable transport, price of gas, big development possibilities, interconnection with the Republic of Srpska, Croatia, Romania and Bulgaria. The initial agreement foresees that the gas pipeline should be financed according to the principles of project financing i.e. mutual capital from Russia and Italy, later joined by companies from Germany and France. The gas pipeline owner – job carrier shall be the newly established company *South stream transport*, in which the Russian *Gazprom* will have a share of 20%, the Italian power company *Eni* 20%, German *Wintershall* and French *EDF* 15% each [13]. The statistics of the *South stream* provides information that the main gas supplier is Russia, the value of the investment project is 16 billion EUR, the total length of gas pipeline is 2.380km, the maximum capacity is designed for the level of 63 billion cubic

meters of gas annually; while the route through Serbia includes 1.7 billion EUR ad valorem investments and 422.4km [12].

The basis for a wider implementation of project financing in Serbia has been created by the increased interest of foreign investors and by the establishment of the legal framework.

Nowadays, project financing is one of the most frequently applied models of financing, above all, of infrastructure projects, for which experts predict a further growth. It is mostly used during the construction of infrastructure objects (transport infrastructure, roads, bridges, power supply networks, waterworks and sewerage systems, telecommunications, oil pipelines and gas pipelines), then the industrial plants (factories, electric power plants, logistics centers) and public infrastructure objects (hospitals, schools, prisons). In all the above-mentioned fields of implementation, the basic characteristic of the project is that it operates as a special economic unit, with the status of a legal person, separated from the mother company, which provides multiple advantages for the project carriers (sponsors) and other participants, and consequently a lower risk for all the protagonists in the project. Project financing is not used in Serbia at a larger scale, except for financing of the construction

of several residential and business objects. In order to intensify its development, Serbia should attract the "greenfield" investments with the help of this concept of financing, which is a good placement for a bank, a smaller participation of capital for the investor in comparison with the conventional sources of financing and a bigger trust for the third parties – buyers, lessees etc.

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THE PROJECTING BASIS OF THE ORGANIZATION OPERATIONAL RESEARCH

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Abstract: The research and projecting of the organization facilitate its operationalization. The application of the operational research is based on theoretical and practical knowledge of the organizational basis of the organization, relations and connections of its factors in the process of functioning and adapting to business operations and actions. Operational research is based on the internal and synergetic interactions of structural, functional and operative criteria of properties, relations and connections of the organization. This work also presents certain operational models and examples of the operational design of the organization.

Keywords: projecting, organization, properties, criteria, design of organization, goal.

1. INTRODUCTION

Each organization is an organizational system (OrgSy), which is characterized by: **the field** of organizational operative activity (FiOrgOpa), **the domain** of action reality (DoActReal) and **organizational phenomena** (OrgPhen). The organization is manifested in the form of properties (Pr), relations (Rel), connections (Conn). The operational method is knowledge and operational way of describing, explaining and projecting one organization. It is the need and the possibility of their design, operational modeling and skilled practice. Therefore, an appropriate approach is required to the basis of the organization operational research. In accordance with the existing scientific, doctrinal, normative and action achievements, the **first chapter** discusses the organizational bases of the operational approach to the organization. The **second chapter** analyzes the aspects of operational shaping of an organization. The **third chapter** analyzes the criteria of the organization operational research, which are corroborated by specific models and examples. The work ends with concluding observations and used extracts from the extensive literature.

2. PROJECTING BASES OF OPERATIONAL APPROACH TO THE ORGANIZATION

As a system, the organization is a totality of the elements, which are interconnected with relations (Kukoleča, 1972).

2.1. SYSTEMIC BASES OF THE ORGANIZATION

The organization can be projected as an organizational system of elements, or groups of elements in a specific order with certain functional properties in regard to the goal (Anton, 1989).

Systems are manifested through the organization, and the organization maintains continuous processes and changes (Kukoleča, 1972).

(Sys \leftrightarrow Org(Proc \leftrightarrow Chg))

Process (*Proc*) - means the change of the system by decomposing and simultaneous constructing structural parts of the organization.

Changes in the system (*Chg*) happen with changes in the organizational structure and state of the system (Anton, 1989).

Structure (Str[n(el \leftrightarrow el)]) is a certain number of elements in one entirety and their interconnections, realized by the linking structure concept (Đorđević, 2006).

There are two concepts expressed through projecting connecting structures: organizational and functional. By the nature of the relations and connections between elements as basic, relatively isolated or particular parts, organization can be projected via hierarchical structure (Figure 1).

2.2 . ORGANIZATIONAL-FUNCTIONAL BASES OF THE ORGANIZATION

An organization is a social and technical creation of people which operates with certain resources, in particular with space and time, according to the specific program in order to achieve a certain goal.

Functions are relations and impacts or effects, the factors that the organization (its elements and components) achieves on its specific structure entirety (Šešić, 1982).

The organization acts like a force achieving the goal, which exists as a creation by maintaining and developing itself. In fact, the organization accomplishes its goals by performing certain task(s) (Kukoleča, 1972).

Operational research tends to support the projecting of monitoring, assessment and prediction of survival - sustainability of the organization as an operative creation from various aspects (stability, efficiency, etc.).

The objects of operational research can be elements, parts, and organizational entirety in terms of properties (pr), relations (rel) and connections (conn) of organizational coherence. They are often manifested, analyzed and projected in space, time, quality, quantity. They can be projected as relations of phenomena, states, structures and operative activities (Petrić, 1989).

Operative organization is characterized by tasks holders' relations and connections, which are integrated into the organizational strength of the goal (Figure 1) .

The strength of the organization is based on target adapted forms-entireties that make it divided into: managing part (Mp) , executive part (Ep) and security part (Secp) of functioning.

From the project standpoint, operational research is an important facility of discovering the potential and the ability to adapt the organization by its target structural and functional changes.

Elements of the organizational structure are people and resources, and the functional structures of activities and actions.

Action is a comprehensive activity element, which generates a specific task - the goal.

Activity - the process of unifying and directing actions which achieve effect - the result (Anton, 1989).

Operative activity – presents all activities in one system (Đorđević, 2006).

The result is qualitatively and quantitatively expressed as a value of some work in certain time based on the defined goal and the given task. Activities of job holders are manifested through functions on an elementary, sectional and general levels of the organization.

3. ASPECTS OF ORGANIZATION OPERATIONAL DESIGN IN PROJECTING

Shaping the organization is based on its *dimensioning* and *structuring*. Operational dimensioning of the organization is possible with the qualitative-quantitative determination of its structure and properties. It is possible to project two types of structure: *organizational (OrgStr)* and *functional (FunStr)*. Structuring the organization is realized in relation to activity holders and operative activity. The process of shaping includes organizational subjects as regional and procedural realities, modalities and equivalents. Operational coverage is possible at: quality (ql) , quantity (qt) and modality (mod - according to the type and degree of the necessity and importance of connection regulations – properties of items) (SYMOPIS, 2010).

3.1. THE ORGANIZATIONAL DESIGN OF ORGANIZATIONS (OrgOrg) is possible on the basis of activity holder (**J, Opa, A**; Table 1.). The basis of organizational dimensioning of the organization is a projected organizational structure of personnel, resources, facilities and procedures. Organizational subjects may include: individuals, departments, divisions, groups (permanent and temporary) by operative activities: a) management, b) executive and c) security operative activities (Table 2).

3.2. FUNCTIONAL DESIGN OF THE ORGANIZATION (FunOrg) is for the purpose of process *dimensioning* and *structuring* of operative organization. It is based on the relations and connections of regional and process factors activities (Figure

2). They reflect the internal stability and **sustainability** of the organization.

Regional structuring regulates the activity holder's relations and connections, while process structuring regulates relations and connections of tasks (Z1. Zn) and goal (G) (Figure 3).

In the process of its target dimensioning and structuring, it includes perpetrators of the function and target strength. Operational design is possible as realities, modalities and equivalents.

1) As reality (creation) it includes relatively permanent relations and connections of elements, parts, and organizational entirety and their need for efficient perpetrators by the quality and quantity of the functional tasks in relation to the effects of the environment.

2) Modality is a feature design by competence holders connection types and relations by specialties of organization elements, parts and the entirety.

3) As the equivalent, they are designed according to the organizational needs for effective perpetrators by the quality and quantity of the special tasks for the management, operative action, and their security in relation to the business organization content through parts and entirety.

4. CRITERIA OF THE PROJECTING IN ORGANIZATION OPERATIONAL RESEARCH

These are the internal and synergistic interactional structural, functional, and operative criteria of properties, relations and connections of the organization.

4.1. RELEVANT ORGANIZATIONAL PROPERTIES, RELATIONS AND CONNECTIONS

A common coverage of their essential relations and connections is possible according to the levels of the organization, which may affect elementary, special and general criteria.

$$Sfa = (\sum Sfa_i (o_c \times c_o)) / n = \frac{1}{n} (Sfa_1 + Sfa_2 + Sfa_3 + \dots + Sfa_n) \quad (1.)$$

Evaluation of general state of organization facilities

$$SfaOrg = \frac{kSfaMd + kSfaOp + kSfaSeb}{\sum k} \quad (2.)$$

a.1. Elementary. Criteria that state the basic factors of the organization: personnel (P), facilities (Fa), other resources (Res).

Example 1. *Quality properties of people*, from individuals to organization - as an entirety, they can be evaluated on the basis of relevant quality of personnel, ranked by the importance of organizational effectiveness: will (will), expertise (es), capacity (cap), experience (exp), responsibility (re) and other qualities.

The author of this work researched the quality of people in one organization, which can be considered as representative for any organization in relation to impact criteria on the state of the organization (Đorđević, 2006). Differences in coefficients influence of the quality (**ql**); relative value of influence from 0.01 to 2.00 were considered:

I) determining quality (ql >1.01 to 2.00) 1) *will*- 63.9%=1.92, 2) *capacity*- 41.8%=1.25, etc.

II) decisive quality (ql >0.50 to 1.00): e.g.: 5) *experience*- 24.59%=0.74, 6) *age*- 18.03%=0.55, etc.

III) existential quality (0.01 < ql < 0.50): e.g: *standard*- 8.20%=0.25, 10) *motivation*- 6.55% = 0.20, etc.

Example 2. The state of facilities can be estimated and evaluated on the basis of general properties:

occupancy (o_c) in relation to a prescribed number and *correctness* (c_o) of facilities according to the requirements of the project.

General state of facilities can be evaluated on the basis of their general characteristics, such as model 1., as parts, as well as entirety of organization by type (eg, transport organizations : fa_1 -buses, fa_2 – off-road vehicles m/v, fa_3 – freight vehicles m/v,.... fa_n – special transport vehicles m/v, etc.), according to the laws of probability based on the *availability* and *accuracy*:

where:

- **k**- coefficient of relevancy for facilities state business operations (can be 1, 2, 3, for exp. for organization of transport, transport vehicle and desk has different significance),
- **SfaMd** – state of management facilities (eg, 2.80);
- **SfaOp** – operative state of facilities (eg, 2.90);
- **SfaSeb**- state of facilities for secure business operations (eg, 2.60) and
- **Σk** – the sum of the number of all applied coefficients of relevancy for overall state (eg, 2+3+2=7).

Example: $(2 \times 2.8 + 3 \times 2.9 + 2 \times 2.6)/7 = (5.6 + 8.7 + 5.2)/7 = 19.5/7 = 2.78$. According to this example, the state of facilities of organization is preferable.

a.2. Special. States criteria of the organization divided on: organizational parts by operative activities domain (management, operations, serving part), their content operative activities (activities: e.g. governance, transport) and secure business operations.

Example 3. The structure of the organization (S_s). Structure state of organizations (S_s) can be shown by the general model:

$$Ss_t = \frac{\sum_{i=1}^n Sou_i}{n} \quad (3.)$$

where:

ΣSou - is the sum of organizational units states, **n** - number of members analysis, and **i** – analyzed number of members.

In relation to the required efficiency, where the criterion relative coverage of the function units holders of operative activities is, particularly, special and general structural state of organization can be: *preferable*, *partial* or *unsatisfactory*.

a.3. General. State organization criteria as an entirety

Operative states reflect synergetic relations and connections of the organization and the environment through assignments.

Operationalization of operative state of the organization (Os_{torg}) reflects relations of its efficiency of functioning with respect to tasks (required effects of work), which is possible to express with the model:

$$Os_{torg} = FEfo_{rg.x} SmSebOr \quad (4.)$$

where **SmSebOr** is the success of measures in the preparation, organization and

implementation of activities, which can be modelled by the general formula:

$$SmSebOr = (SpOr + ScontentSebactivities)/n \quad (5.)$$

The knowledge of operational state of any organization, particularly companies, and the knowledge of application of the quantifying method is required.

Depending on the segmental and overall operational state of the organization, state operationalization of its capacity is possible, in relation to shorter or longer periods.

Example: $Os_{torg} = FEfo_{rg.x} SmSebOr = FEfo_{rg.x} (SpOr + ScontentSebactivity)/n = (2.721 \times ((2.89+2.78)/2)) / 2 = (2.721 \times 2.835) = 90.7\% \times 94.5\% = 0.907 \times 0.945 = 0.857$ or 85.7% or **2.57**, which is *preferable*.

4.2. COMMON CRITERIA CONNECTIONS AND RELATIONS

Common criteria connections and relations for all forms of state are degree of factors'

impact on the state of the organization, such as a company, that is possible to express with different *coefficients of relevancy (cr)*, which may include: deciding-large (**cr-3**), opting-medium (**cr-2**) or influence-small (**cr-1**).

5. CONCLUSION

Operational design of the organization with qualitative-quantitative properties has an integrative influence on projecting its effectiveness and efficiency within certain elementary limits, both by organizational units and organization in general.

With the operationalization, projected quantity can be partially compensated with the necessary quality of the organization and vice versa. Developing operational projecting of the organization, researching its properties, connections and relations between the organization and the functionality significantly improves the optimization of the organization adjustment to challenges of time, conditions, needs, missions, tasks and limited resources for various actions.

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ADDITION

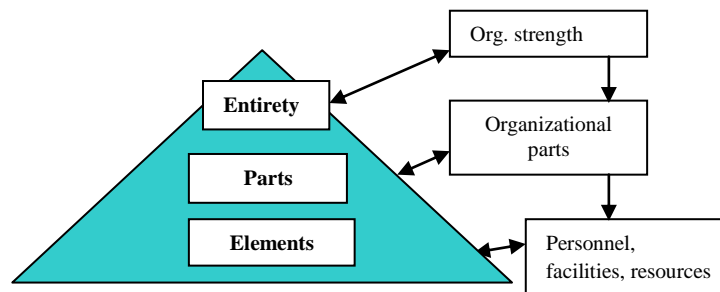


Figure 1. The hierarchal structure of the levelled organization

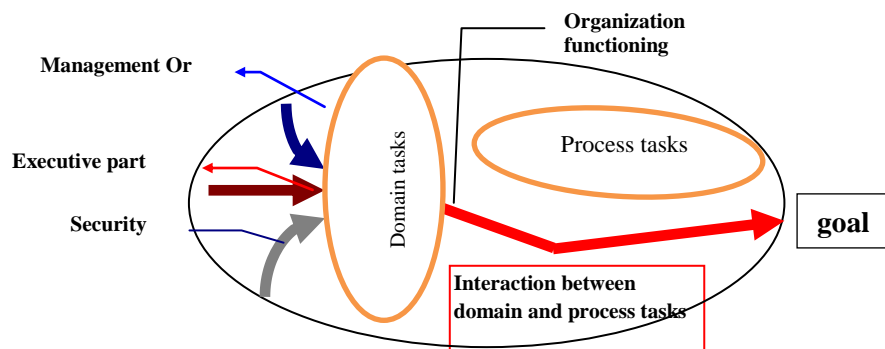


Figure 2. The functional structure of the organization

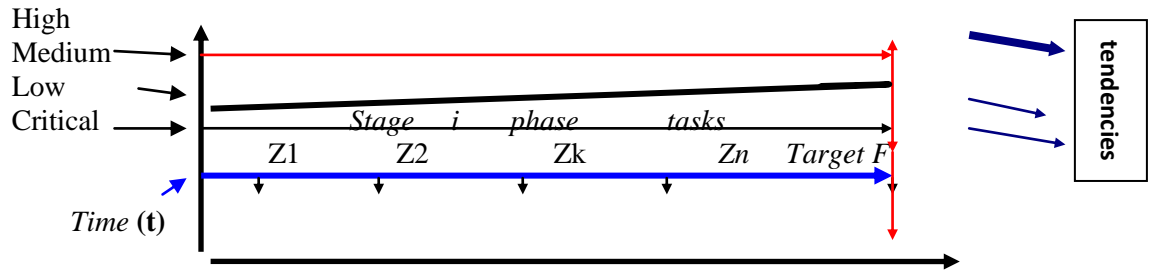


Figure 3. Possible states of levels and tendencies of the organization functionality

Table 1. Levelled access to the structure of activities, effects and states of the organization

Organization level (Lo)		Activities(Ac)		Effect (Ef)		State – problems (Sp)	
E	Elementary	J	Jobs	Et	Elem. tasks	E	Elementary
S	Sectional	Opa	Operative activity	Gt	General tasks	P	Parts
G	General	A	Action	Gef	Goal	G	Goal
\mathcal{S}_1	Structure of the Organization	StAc	Structure Ac	StEf	Structure Ef	StSp	Structure Sp

Table 2. Levelled access to the organizational structure of elements, parts and entirety of the organization

Organization level (Lo)		Personnel (P)				Facilities (Fa)				Resources (Res)			
E	Elementary Oc	Org	Mp	Ep	SecP	Or	Mp	Ep	SecP	E	Mp	Ep	SecP
S	Sectional Oc	Org	Mp	Ep	SecP	Or	Mp	Ep	SecP	P	Mp	Ep	SecP
G	General Oc	Org	Mp	Ep	SecP	Or	Mp	Ep	SecP	G	Mp	Ep	SecP
\mathcal{S}_1	Org. occupancy	Org Oc	Oc P			Org Oc	Oc Fa			Org Oc	Oc Res		

STRATEGIC, PROJECT AND VIRTUAL PROJECT MANAGEMENT

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Abstract: Management project activity in starting a new business or remodelling of the current falls is, as a rule, the most complex and the most delicate management of ventures and activities. Depending on the type of the project and the conditions under which it is running, management project activity is implemented by particular, specific procedures that employ respective material and financial capabilities, as well as personal subjective performance of entrepreneurs committed to a successful project outcome. Project management is scientifically based and practice confirms that the concept that using the appropriate methods of organization, planning and control rationally harmonizes all the necessary resources and coordinating the performance of necessary activities to a project implemented in the most efficient manner .

Key words: project, project management, project implementation, virtual project management.

1.INTRODUCTION

The word "project" is an ambiguous term that has several specific terminology meanings.

The construction of each building object precedes the production of a specific project. First, it is the preliminary design (drawing) in which it is presented, perceived, and assessed and the technical and functional ideas asserted. If the preliminary design approach is adopted then a construction project is made, which typically has several parts: the main design project for water and sewerage project energy, pro-lighting project, project telecommunications. and other projects. According to another definition of the word, design means a specific goal or project of a complex and atypical character, which should be implemented or performed. According to our expert in project management, professor Peter Jovanovic, "project is a complex unique business venture that is undertaken in the future, in order to achieve certain objectives committed within the allotted time and the projected costs".

The basic features of the project are as follows:

1.Objective: It is a venture with one or more precisely focused objectives to be achieved.

2.Significance: This is a special project, usually of exceptional significance - it is an endeavor whose realization achieves big developmental effects of a business that is commercial and financial, social and / or others.

3.Extent and nature of tasks: It is a unique and unrepeatable venture or task: it is a one-off project with whose completion the project ends; it is an undertaking that requires a special commitment and support.

4.Complexity: It is a complex undertaking with usually a large number of participants; it is a complex project which involved participants who perform a variety of the jobs, but they are also centralized and harmonized.

5.Terms: It is a project that is being implemented in the future, for the future. It is a venture that has a shelf life and the life cycle; - it is an endeavor timed with the start date and the end of the implementation; it is an endeavor in which each phase (sequence) and the performance of the implementation is time determined.

6. Organizational structure: It is a project that has all the elements of a rounded business processes; - it is an endeavor that consists of interconnected phases and activities - it is an undertaking that requires coordination (functional adaptation) of all participants in the implementation; - it is an endeavor that is usually performed on a particular type of network plan.

7. Risk: Due to the uncertainty and the future, which is always unpredictable, the project is, as a rule, immanent to a degree of risk and uncertainty; - during planning and during project implementation these parameters should be incorporated into the project to reduce the risk to a minimum potential measure.

8. Information system: It is a venture that requires special and jagged information system; - it is an endeavor for which the information is obtained from various sources.

9. Control system: It is a venture that should be permanently controlled in all phases of work and by involved perpetrators; it is an endeavor that, due to the unpredictability of the relevant events, must be revised.

A typical example of the entrepreneurial business project is the establishment of a new program or restructuring of existing enterprises. The realization of this type of enterprise is coming to the fore all of the following basic characteristics of the project. An entrepreneur who runs this endeavor to a specified finish, has all the above characteristics of the project asserted into account. Neglecting only one of the characteristics (determinants) of the project can result into big problems with the price that the project fails. Types of projects - enterprise accounts. There are several classifications of projects as enterprise strategic charts show.

I. According to the functional areas of business to which they relate, these projects can be classified according to the following definition:

- Projects in the field of production: the introduction of new production, modernization of existing production, etc.
- Projects in marketing: establishing new channels of procurement of modern systems of logistics, the introduction of new or expansion of existing sales channels, creating a new system of promotion, etc.
- Projects in the field of investment and development: the construction of new plants and offices, reconstruction of the existing capital stock, and other projects of a functional nature.

II. According to the object and purpose the projects can be classed into the following groups:

- Investment projects in new areas and buildings
- Projects for investing in the reconstruction and expansion;
- Investment projects in the dislocation of the existing facilities and resources

- Projects investing in scientific research, the development of information-system, staff training, and other development activities.

III. According to the length of the project, the complexity of the project, engaged resources, applied methods of implementation and char-TERU organization, projects can be divided into two basic groups:

- The projects are new construction or reconstruction (expansion, modernization) of existing plants, business centers and other commercial properties;
- These are projects of spatial expansion and / or dislocation of the business unit into new areas; - in business and entrepreneurship they are construction projects associated (secondary) infrastructure, access roads, power lines, telecommunications, water and sewerage and other infrastructure.

Characteristics of ongoing business projects also include:

- Project analysis and expertise of the existing business of the company;
- Making planning (design) documentation of various character,
- Introduction of the new business;
- Introduction of quality - the introduction of a new or modernization of an existing information system (inform-situational System)
- Analysis of opportunities for marketing and penetration into new markets;
- Explanation of new methods and contents (displays, exhibits) in promoting,
- Organized knowledge innovation concerning both managers and employees;
- Implementation of new import and / or export enterprise;
- Establishing new channels of investments;
- The start of production of new articles and other current development projects.

IV. According to their purpose, projects can have surely different options. In this sense, we can differentiate among the following various projects.

- Investigative character: marketing research, product research, technology research, research policy and legal businesses and other research projects,

- Project of planning and development of character and detailed design, production and other plans and programs of the mid and long-term nature - Projects and Development conquest: conquest and technology development; conquest and product development; conquest and market development (channel acquisition and channel placement) and other conquests and developments,
- Projects of investment character: the construction and equipping of new spaces and buildings, reconstruction and modernization of the existing facilities and structures; sanation and / or technological remodelling of threatened and / or obsolete abusive space, facilities, installations and equipment.

V. The strategic orientation business projects can be developed to:

- Project positioning a new business - when entering into new business subcatch.
- Projects repositioning the existing businesses which (repositioning) may be made in the direction of expansion (expansion towards revitalization modernisation and improvement); toward recovery (healing) of the company, rehabilitation facility (department), rehabilitation of canal traffic reduction (narrowing) or in the direction of gas-learning unprofitable and non-profitable business.

VI. According to a separate (specific) definition of projects, they can be differentiated by very different grounds. In this sense we can talk about the following projects:

Projects of cooperation and / or integration - which can be classed as follows:

- Business and technical cooperation projects,
- Projects of commercial cooperation,
- Joint appearance on third markets
- The realization of joint ventures and other cooperation projects and / or integration of the resource potential of different character

Project organization and reorganization of the company or certain parts of the company involves as follows:

- Project of building a new organization,

- Restructuring Project existing business system or parts of the system, mergers, acquisitions, or separation of individual organizational units and other projects of a similar nature; - environmental projects and projects for rehabilitation and protection of the endangered working environment: - Projects of social character that can be related to the hiring of women workers within the company of a particular area, and other projects.

After allocating strategic and business development and approval of business plans and other related planning documents with which the necessary dynamic, contents and details specifically define a determined business, follows the fifth stage, the fifth step in the procedure of strategic management. The fifth phase of the strategic management to build new or remodel existing business is achieved through the implementation of the preparatory and operational activities that (activities) are usually of investment and post investment character. The preparatory and operational investment and post - investment activities are performed by relevant task entrepreneurs and top managers of the company, who provide realistic, documentary (programs and projects operating performance of the investment), institutional (municipal permits and approvals), financial (money) , material (fixed and current assets), location (space) personnel (human resources) and other investment securities and conditions for the initiation and successful implementation of the asserted business.

A successful realization of preparatory and operational investment and post - investment activities requires special skills and qualifications of management. Ability in this specific case means the willingness and commitment of management to achieve opting investment and post investment objectives and implement the project . Qualifications , on the other hand, refer to the technological and organizational knowledge with which to dispose of the processes and procedures of keeping the asserted business.

Software operationalization of the determined investment, if the investments are complex in character, as a rule, is carried out through special operative term plans. Operational plans of the company are made by an

entrepreneur (top manager), or on a special assignment and authorization: suitably qualified management of sector (secondary) level. In large and complex organizations, entrepreneurial, operational plans with which to implement development investments - at the level of the entire business -system, often the result of coordinated synthesis of operational plans for individual papers and / or other organizational units that constitute the operating system organization.

The entire procedure of investment and operating post investment activities that precede the commencement of work and the current implementation (commercialization) of the asserted business can be in general divided into two groups, functionally and temporally separated, the business stages. These are :

The preparation phase of investment and investment, and post investment phase of the preparatory activities related to the management of resistance to starting up regular current planned work.

For the performance of the first and the second phases of investment activities the entrepreneur or top manager must have the appropriate financial and successful business and investment.

Investment preparation and the investment is realized through a specific procedure in which the activity of management in theory and practice of business is called Project management. Conceptually expressed, project management means a special kind of management relating to the management of the project. Bearing in mind that starting a new business or remodelling the existing business is serious business venture and is a specific type of project, we will keep the reader's attention briefly to explain the concept of project management that just applies to investment preparation and implementation of specific investment projects. Investment preparation and implementation of investment in most cases is the investment into the asserted implementation of the business plan - certainly if the implementation of the plan is based on investment

Project Management is a special type of management relating to the designing of

planning and implementation of the project enterprise. The project usually implies undertaking the activities in order to achieve defined goals - in the allotted time, within the foreseen resources and projected costs. In this sense the definition of project management and project management can be defined as follows:

"Project management is the business of insurance to the ultimate goals of the project with all the risks and problems that arise in the implementation". Our probably most informed expert in project management, professor Petar Jovanovic, proposes another definition of project management, which may define the term project management more accurately. According to him: "Project management is scientifically based and practically confirmed concept of using the appropriate methods of organization, planning and control and rationally harmonizing all the necessary resources and coordinating the performance of necessary activities so that a project should be implemented in the most efficient manner."

Project management and project implementation are usually performed by a network - precision level with which it is primarily determined by :

- Holders (executives, operators) of the project
- Technologically separate phases of work
- The beginning and end of individual phases.

The network plans to be used in the implementation of the projects can be shared while in the two groups. These are :

- Global network maps of the entire project
- Partial (segmental; detailed) network maps of individual parts of the projects.

The development and implementation of the business plan of a new and complex business which needs to be run, can be treated as an example of a global project. Bearing in mind that the development and implementation of the business plan, its implementation should certainly be carried out in phases and some characteristic functional segments, where we can distinguish: separate conceptually distinct and rounded segments, such as segment management and organization; segment technological processes and technology,

segment marketing (procurement, sales, promotion, logistics) and other segments. For the development and implementation of each of these segments of the business plan can be created and also a special partial network plan, according to which people and activities that are associated with specific business segments will be organized and led.

Project Management involves the principle of defining the next project parameters, and performing the following procedures and activities of the project activity:

1st Management of objectives and content of the project involves precisely taking the objectives and content of the project and continuing care charge (charge) management for CSOs to achieve the adopted objectives and activities;

2nd Management of the project scope means that the project is defined to the extent (global and local) to be in the situation to be optimal for achieving the projected business goals;

3rd Time management project involves the precise time established for all the phases of the project - which usually determines the corresponding dynamics or network plan, and a consistent observing of these during the implementation of the project;

4th Quality management of the project involves the management that develops and implements the project permanently concerned that the qualitative side of the project is satisfied - in all relevant aspects of the content and implementation.

5th Managing the cost of the project means that the adopted project is implemented in a rational manner, which ensures both the quality of the project plan and the cost effective execution;

6th Marketing management project involves the procurement activities, logistics, promotion and communication, as well as the sales achieved in a meaningful and quality manner that will ensure the achievement of optimal effects projected for a business;

7th Management of the staff of the project involves responsibility scope of involvement and responsible attitude of top managers and sector managers who manage the project in relation to human resources involved. The above engagement (and relationship) should not promise misery to every situation - during

the course of the project the right people find the right place and at the right time ;

8th Managing change in the project includes not only constructive and eventive attitude towards the changes that the implementation of business conditions, but also moves to execute certain changes and wisely manage them - when certain (determined plan or spontaneously arising) circumstances require;

9th Risk management project is the ability and willingness of management for CSOs to project the probable risks which can appear during the project, properly and timely identify them and, based on the available opportunities premanifested, either take measures to eliminate risks.

10th Conflict management in the project means that the entrepreneur or manager who is leading the project builds and develops their own emotional intelligence, to become emotionally capable, able to manage wisely and solve conflicts that are ongoing with the implementation of the project and can be manifested among the interested differently motivated actors (people, agencies and firms) in the course of project implementation.

2. PROCEDURES FOR PROJECT MANAGEMENT

Project management activity of starting a new business or remodelling the current falls is, as a rule, the most complex and the most delicate management venture and activity. Depending on the type of the project and the conditions under which it is running, project management activity is implemented through a particular, specific procedures that (procedure) and be sure to choose the material and financial capabilities, as well as personal subjective performance of entrepreneurs committed to a successful project report.

Viewed globally, the basic stages (sequence) in the implementation of development projects that are of investment character, may be determined and structured as follows:

Phase I: Design and Development (Analysis) of project ideas;

Phase II : Identification and definition of the project;

Phase III: Decision making, planning and preparation of the project:

Phase IV: Investment performance (primary implementation) of the project:

Phase V : Completion and assessment (test) project - pilot production and / or test operations;

Phase VI : Commercialization (current business use) the completion of the project, that is, the so-called secondary project implementation ;

Phase VII: Permanent control and, where necessary and possible, revision (change) of project that is in the business (commercial) exploitation.

The above procedure implementation and operation of the development (investment) project is called the theory of management "project life cycle ". From what we have pointed out above it can be concluded that a comprehensive project management includes all phases of project activities - from the development of the project idea, to primary and secondary implementation of the economic and technological " death " of the project and its replacement with other modern, profitable and prosperous projects.

3. MULTIPROJECT MANAGEMENT

Large and complex entrepreneurial organizations, which carry out certain investment works as a specialized design and construction organizations involved in the design, construction of buildings , installation of equipment and other project and investment activities are often carried out as more strategic and development projects at the same time. The aforementioned plurality of project activities and conditions of the management of such organizations. One feature of multiproject management is that, according to the nature and dynamics of the kinds of the project tasks, forms of project teams, each team is responsible for the management and implementation of a specific project . Each individual project team has its own terms of reference and their managers (Executive Manager) who take care of the realization of the project of which his team was in charge . We must be sure that there are no impediments to individual project managers and that business executives also participate in the implementation of a number of different projects.

Multiproject management is particularly implemented in case of the design and construction of entrepreneurial firms, whose basic task is the realization of business projects. According to the business (project team) and according to the available people and the available material resources, the company's owner (entrepreneur) and top managers issue work orders with which they borrow and authorize certain sector managers and executive staff to engage and work on specific projects.

We have to keep in mind that the management of complex projects is typically a teamwork . Turn on positive grounds of our own advisers and co-workers: technicians, financial planners, bankers, accountants, attorneys.

4. VIRTUAL MANAGEMENT PROJECT

In situations where the project (planning and performing arts) activity is very complex and highly uncertain, the system of virtual project management i.e., Virtual project management for CSOs is often applied in the practice of project business. Such a system, as the word says , is based on a virtual project assignment and virtual project team, who are computer simulated and networked with each other and in managerial and executive project interactions. The aim of the virtual creation and implementation of the project lies in the fact that there is a knowledge and solutions that will then be used in a real applicative project practice.

Virtual project management was used in the management practices of ancient times. It was first used in the army through a virtual simulation of war and battles to be delivered. Later it was also used in business : maps, figures, drawings, various algorithms and other funds, displays (exhibits), presentations. With the development of computer technology and the Internet affirmation managers who virtually designed some complex business tasks get a powerful tool for planning and testing their management aims and objectives and a verification of the intended projects.

Virtual design is beneficial because it reduces the risks of the business which can be devastating to both the business and the entrepreneurs. The fact is that in the virtual design and virtual realization of the project in

certain business ventures and in some areas of business, risk can be significantly reduced because before the start of the real work previously virtually illuminated and checked is (tests) the uncertainty which is the main enemy of project management.

Virtual project management in particular proved useful in application programs and multiproject management

The implementation of large and complex projects especially those of investment characters requires the inclusion of not only different managers and specialists, executors of the project, but also sometimes of different types of specialized organizations. Sometimes it also requires the inclusion of business partners (companies or individuals) which can occur in various investment and business status.

The fact is, that the implementation of large and complex projects, of business investment character, in addition to an entrepreneurial firm that is an investor and principal (responsible) system, the implementation of these projects also include to a greater or lesser extent:

- Project organization (preparation of project documentation);
- Performing Organization (performing various types of works);
- Assembling companies (construction and installation of equipment and devices);
- Consulting and engineering firm (management of technical and / or financial supervision, consulting, engineering services) ;
- Financial institutions (ie, co-investors and creditors) and / or
- Other organizations.

Some of these organizations may have a status of business partners (partners, coinvestors), a major contractor status, as well as comprehensive project activity is then coordinated (functionally aligned) and synchronized (time adjusted), in order to design quality and time desirable and acceptably performed and then successfully business commercialized.

Having successfully completed all preinvestment and investment activities, which are material, location, program, technology and the other based on ordained

business certainly if it precedes a planned business investment , an approach to the operational phase, following preparatory work. This stage refers to the activities of project management related to creating and providing conditions for starting a determined job and enter a phase of regular production and the phase of regular serving and transport (in case of service transport business) . The preparatory activities prior to commencement of work and its subsequent successful implementation include the following tasks of project management that is:

1stChoice, followed by the introduction of appropriate organizational structure (schema) on which to base the distribution of powers and responsibilities of employees and direct perpetrators of the work as well as the internal organization of the newly formed business systems;

2ndSelection of personnel, training and introduction of officers for allocated business;

3rdSecuring financial resources for starting and maintaining a current job;

4thProvision of material resources propagating material of merchandise small tools and other resources that are material in the assumption and condition of asserted business;

5thDevelopment of operational plan implementation, monitoring and control of the business and its application;

6thLaunch of trial production and operations, monitoring implementation, and possible revision of the running process;

7thRealization of a planned venture, which is achieved through the regular operation of the installed capacity and human resources involved.

The organizational structure reflects the company or division of labor and the division of powers and responsibilities within the company . We must be technologically and logically connected, entirely composed of appropriate organizational units in which technologically connected and functionally - rounded operations are performed .

Depending on the size , type and complexity of the organization, as well as depending on the content of its work organizational chart, entrepreneurial firms may be differently

determined and structured. Most usually: inline, functional, manufacturing, process, territorial division mixed project; innovation, contingency, re-engineering and ad hoc system of organization, which is in practice most applied.

1st Line system of organization based on strict subordination (dominance and subordination) includes business perpetrators, each executive job manager or employee operating accurately knows who he is superior and who is subordinate to the subject business.

2nd The functional organization of the system is based on the basic functions of the firms in which they perform. With this system, the organization of the company is divided into sectors or other organizational units, sectors that perform various business functions within the company. Depending on the activities that may include the sectors of production, marketing sector, the sector of financial affairs, the Legal and General activities and other sectors.

3rd The production system of organization shows that the company is organizational fractionated by basic products (items) that are produced in the company or that the company sells. For example, a holding company engaged in the production and / or sales of sports equipment can have a special pre rapture : the manufacture of boats , for the manufacture of tents , camping equipment for the production of the other.

4th Process system of organization, as the word says, is based on the patterns of business processes that are materially and functionally separate, but which are still technologically connected because they represent certain technological and commercial complex.

5th The territorial organization of the geographic system implemented includes companies operating in the wider geographical area of the country and / or abroad. With this system, the city or state in which business is done and the seats are organizational units (separate technological units).

6th Division (mixed) system is an organization designed as a combination of the previously mentioned systems of functional, production, process-up or geographical models of organization.

7th Project delivery system, used by organizations that deal with multi project activities design , construction, installation, consulting engineers and other similar companies. Any major work , which is treated as a separate project, is the basis for the establishment and organization of special project and resource entity, human, financial and other, that are assigned to the project and implemented .

8th Matrix system to organize the system, which is also based on the combinations. This system is primarily a combined functional and project organization chart.

9th The innovative system of organizing the original schematic model of organizing that is based on the unusual (non-standard) and atypical approaches to structuring personnel and other resources with which to implement some given resources to perform certain tasks, for which the company is founded.

10th Contingency system of organization is somewhat similar to the previous innovative system. Unlike the previous (innovation), which is more research and avantgarde in character , the contingency system is formed also as an atypical but precisely allocated according to specific task, specific terms of business operations of a specific time and runtime.

11th Ad- hoc system of organization also has some similarities and contingency model of organization. Since these models are distinguished by the degree of improvisation , which is in an ad- hoc system, much more pronounced. An ad- hoc system presupposes the establishment.

12th Reengineering is a model of organization based on the demolition of the existing system and building a new one.

The conditions for business have their contextual specifics that need to be taken into account when allocating the constitution and mode of organization schemes of all resources for business. Benefits of good choice of models and real scheme of organization can be multiple. Also, the damage from the wrong choice of models and patterns of organization can be very large or even ruin the company and the job, especially if the model and pattern of organization have not been tested.

Tactics is part of a strategy. In a well run management tactic is precisely aligned with the strategy, and, in terms of technology, derived from it. In contrast to the strategy, which is typically a long-term development in character, the tactics is short-termed or possibly medium in targeting and implementation. Tactics never stands for itself, and only serves a longterm strategic goals. As the strategy is a means to achieve certain goals of business owners or top manager, so the tactics means to achieve a particular strategy. The basic purpose of the tactics is to ensure the realization of the adopted strategy.

The operational part of the tactics and is a way, and sometimes a phase of tactical action. Operates is a temporally and spatially specific set of technological operations aimed at a particular job, primarily tactical, and possibly strategic (development) in character. It is usually performed by lower managers and executive staff.

"It is not a trick to formulate business strategies. The trick is to achieve it", said the American management theorist Igor Ansof. Igor Ansof is absolutely right. Quality is a concept and the quality of implementation is something else entirely. The differences between the successful and unsuccessful entrepreneurs and successful and unsuccessful top managers are not only in the field of design quality business procedures but also in the field of skill to be determined procedures successfully implemented.

Implementation and commercialization of the current business represents the sixth stage, the sixth step procedure of global strategic management, aimed at launching a new or remodelling of existing businesses. The above phase is achieved through having to carry all of the relevant investment and post-investment activities of the organization and technology empower business system of normally present operations. The current implementation of the business is the fact implementation opting the target strategy and focusing the strategy if there are more, to be implemented effectively to achieve goals and progress of companies. Implementation of Business - speaking in terms of technology is carried out through three basic sequences of management activities, which are related to

each other while the actor is not. These are the standard management of each sequence, and that in the operation plane of administration of action is defined as:

- Planning (operations),
- Implementation (operational) and
- Control with a possible revision (operational).

Each of these sequences implementing business - planning, implementation and control is done through three distinct phases associated with each other too, and this in turn phases: planning, implementation and control. In the excellent book "Managing projects, Professor Petar Jovanovic presented a draft cycle implementation of business, which in an original way shows a functional interdependence between these phases.

The operational phase of implementation of business represents in fact a concrete implementation opting strategy or strategies, from the moment of commitment of entrepreneurs to business through direct preparation to direct operational implementation.

The operating current implementation of the business, as a rule carried out by the second management scheme, in a different manner, and commonly with the other persons with respect to the investment implementation or preparation of the investment, which preceded the current realization.

If the investment preparation consists of tasks and activities including the design and construction of buildings, installation of equipment and devices, and similar tasks and activities, the special scheme of organization in these activities involves the designer, builders, installers and other professionals in the design and the performance of the construction and installation work. These professionals are, as a rule, involved temporarily to perform the tasks until the investment project is complete.

The operational implementation of the current business involves mainly full-time employed managers and workers. Their job is, if it is production, sale or provision of services, repeatable and continuous and is performed by the program scheme that has been carefully technologically determined.

Implementation of the development strategy of the company is very important. Implementation of the current business is carried out in a manner that translates strategic goals and objectives into practical operational (technological and organizational) activity and are achieved through the implementation of the adopted tactical and operational plans and other documents.

Depending on the nature of entrepreneurial firms, market situation, and the ambitions and objectives of the top management, strategic implementation of business process can be realized in different ways. The general strategy of implementation of the business plan asserted to start up a new business, remodelling an existing business, include the following technologically connected and functionally differentiated steps:

1. Analysis and evaluation of information obtained or based assumptions as to certain parts of the organization and / or the company as a whole - if it exists and operates , changes have to be committed to the business plan and the adopted strategies based on it successfully implemented.
2. Analytical anticipation (looking ahead) and assessment of planned changes to the existing already constituted a formal and informal organizational structure of the company as a whole as well as the organizational structure of individual parts from which the company is made.
3. Analytical anticipation and implementation of planned changes to the corporate (or the organizational) culture and climate of corporate firms.
4. Selecting the right attitude and approach to the management of affiliation and implementation of the target current business strategy.
5. Preparation and implementation of opting target strategies - strategies in the system.
6. The implementation of the current business strategy.
7. Evaluation of the results and possible revision of management practices and procedures.

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- 14 Project close-out

To be published September 2013

Proactive Project Management

How to make common sense common practice



By Morten Fangel

We all know what it takes for a project to be inspiring to be a part of and to lead efficiently to the requested outcome. It is common sense to be proactive in the management of a project!

This book claims that it is a kind of *natural law* that we immerse ourselves into the project execution – even at stages when proactive project management is needed for creating suitable conditions for the project execution. The consequence is that the project management takes place *reactively*, after the problems have already occurred during the execution.

This book aims at shifting the project management from taking place *reactively* – towards, to a greater extent, taking place *proactively*. To be proactive implies that the management initiatives takes place where managerial challenges have not yet occurred or been recognized by the participants and parties.

A shift from recognizing what is common sense – towards making it common practice implies a conscious and persistent effort by the project manager and other partners involved in the management of the project. The book supports such a shift by presenting a variety of mindsets and related methods and tools.

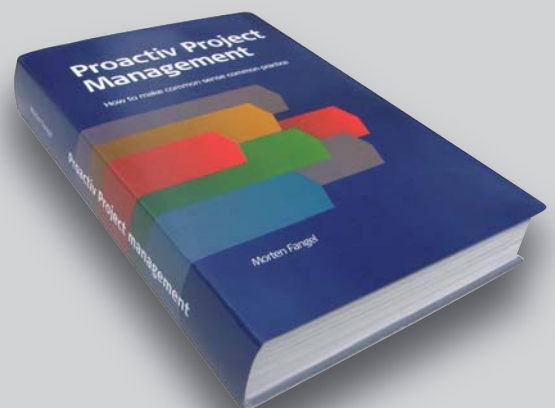
One mindset is that the project management process itself should be lead. You promote proactive project management by planning and evaluating relevant management initiatives – and by adapting the level of effort and the tools for the project's degree of complexity. The entire book can be considered as a method with tools for such planning and evaluating the project management.

Another mindset is that the project management is not only a task for the project managers. The project owners, the participants and other parties must also be proactively involved in the management process. Such co-management means that the analyses and plans created will become more relevant- and have more impact on the project process. The general tool for such an approach, as presented in this book, is to *facilitate* the management activities.

The entire book is a *supplement* to the existing literature on project management. The new mindsets and methods promote the idea of being a more *reflective* project manager – and thereby gaining even more benefit from knowledge obtained from other books and from personal experiences.

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Praksa

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V Semestar

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(Studenti biraju dva izborna predmeta)
Završni rad

NASTAVNI PLAN MASTER AKADEMSKIH STUDIJA - POSLOVNI I INOVACIONI MENADŽMENT

I GODINA

I Semestar

- Savremeni menadžment
- Liderstvo
- Inovacije i preduzetništvo

II Semestar

- Elektronsko poslovanje
- Upravljanje znanjem
- Operativni menadžment

II GODINA

III Semestar

- Upravljanje finansijskim rizikom - Izborni
- Finansijski menadžment - Izborni
- Menadžment u javnom sektoru- Izborni
- Finansijska tržišta i institucije - Izborni
- Upravljanje rizikom - Izborni
- Upravljanje tehnološkim inovacijama - Izborni
(Studenti biraju tri izborna predmeta)

IV Semestar

- Praksa
- Završni rad