PROJECT MANAGEMENT IN SURFACE MINING OF MINERAL DEPOSITS BY PROJECT PORTFOLIO MODEL

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Abstract: The Project of opening and developing a surface pit mine is usually related to strategic decisions of a mining company and may have crucial significance in terms of its future development. The first and most delicate phase, in which the strategic visions are reshaped and concretised, is the pre-investment phase, whose aim is to provide high-quality basic data in terms of investment-technical documentation developed in various levels of detail. The implementation quality of the mining project pre-investment phase de facto determines the ultimate success of the implementation of the entire mining project. Organizing and managing the preparation of the investment-technical documentation for the opening and development phase of the surface pit mine according to the project portfolio management model can significantly reduce the uncertainty of the project realization and reduce the project risks to acceptable levels, creating the prerequisites for reaching optimal business decisions with regards to the continuation of the following phases, and thus the realization of the project as a whole. The aim of this paper is to present basic definitions in the area of project management in the context of selecting an optimal model of organization and project management with regards to the opening of surface pit coal mines, which in terms of complexity, scope, duration, and impact on the environment, surely deserve modern approach in the field of organizational theory and practice, especially since, historically speaking, the problem of organization and management of investment projects has not been taken into consideration sufficiently by the mining industry. This paper provides an example of the organization and management of the investment-technical documentation of opening and developing a surface pit mine on the basis of the project portfolio model.

Keywords: project, project management, project processes, model, portfolio

1. INTRODUCTION

Even though project management area was developed from technical disciplines, it was influenced by other business areas, and it is increasingly becoming multidisciplinary. Therefore, for the successful operation of the entire project, not only a narrow area of project management should be taken into account, but also an organizational structure and environment of the project, knowledge from the area of project implementation, standards and legal framework, knowledge of business management, economics (especially finance), interpersonal relationships, and so on. Each of the aforementioned factors may influence the success of project implementation.

Although many authors were engaged in defining the terms of project management area, such as project, project management, program, portfolio, etc., it seems that the most general accepted definition was the one made by PMI (Project Management Institute, USA), stating that a project is a temporary group activity to produce a unique product, service or result.
2. DEFINITION OF TERMS

2.1 Project

In the effort to define the term “project management” it is necessary to define the concept of the project itself. Since most of the authors dealing with the project management were involved in the development of knowledge catalogue, published by PMI (Project Management Institute, USA), PMBOK Guide [1], or made references to PMI definitions in their own works, such definition has been accepted as the most general.

Otherwise, apart from PMI, there are several associations that operate on a global scale in project management areas such as the IPMA (International Project Management Association) and APM (Association of Project Management), as the most important ones in Europe. Like the PMI, IPMA has issued its own knowledge set called Competence Baseline [2], while the APM issue was called Body of Knowledge [3].

As mentioned before, PMI defines a project as a temporary group activity to produce a unique product, service or result [1]. From this definition two important items can be observed that distinguish the project from operational work. The first is that the project is a temporary activity, meaning that the project has its beginning and end. Likewise, the project team is assembled during the period of the project and is adjourned after the project is completed. In other words, human resources are made available for other projects or operational activities. Another important feature is that a project has created a unique product - service.

Furthermore, a project can be defined as a set of activities and tasks with a specific purpose, defined specifications, beginning and end, limited financial resources, human and technical resources. Likewise, the project can be defined as a set of activities performed in a logical series in order to obtain a certain result, with each activity, as well as the whole project, having defined its beginning and ending.

Basically, during the definition of a project, all the authors of the project use the most general definition given by the PMI, which is, thereupon, more or less modified in order to optimize the implementation of the project.

2.2 Project Management

If the PMI is taken into account as the most general definition of the project, therefore project management is the application of knowledge, skills, tools and techniques in project activities in order to meet project requirements [1].

Project management includes determining requirements, setting clear and achievable goals and balancing the competing demands for quality, scope, time and cost. Likewise, project management is often defined as a set of methods and techniques based on accepted management principles used for planning, evaluation and control of work activities in order to achieve the desired goal on time, within the budget, and in accordance with the provided specifications.

2.3 Program and portfolio

As the entire process of project management, especially in complex organizations, takes place in the broader context than that of a single project, it caused the occurrence of such concepts as program and portfolio, with related concepts of program management and portfolio management.

The term “Program” usually denotes a set of interrelated projects organized to provide benefit that would not be possible if it were a solo project [1]. According to the
same source, the portfolio is a set of projects or programs and other works grouped together in order to effectively manage the activities to achieve the project objectives.

2.4 Project processes

A process is a set of interdependent actions and activities performed in order to obtain a predetermined set of products, results or services [1]. Project processes are presented as unique well-defined process activities even though, in practice, they sometimes overlap in methods that are difficult to define. Generally design processes can be divided into several groups [1]:

- Initiating Process Group- defines and approves the project or project phase;
- Planning Process Group - defines and specifies the purpose, plans direction and actions for accomplishing the goal and scope;
- Executing Process Group - Coordinates human and other resources to implement the plan;
- Monitoring and Controlling Process Group - measures and monitors the progress to identify deviations from the plan and perform corrective action;
- Closing Process Group - formalizes the project acceptance, i.e. the results of the project or project phase, leading to the completion of the project or project phase.

For successful project management it is necessary to select an appropriate set of processes based on the complexity, risk, size, timing and experience of the project team, resource availability, the amount of available information, organizational maturity in project management as well as in the area of application. At the same time, they represent the variables by which projects can be classified into groups.

2.5 Project management methods and methodologies

According to the PMI, methodology is defined as a system of techniques, procedures, and rules used by a person operating within a certain discipline where the procedure is a series of actions that take place in a particular order in order to obtain a certain goal [1].

J. Charvat defines methodology as a set of guidelines and principles that can be tailored and applied to the specific situation [4]. According to H. Kerzner, a good methodology displays all the important processes of project management, therefore allowing the areas that are involved in the process to continue spreading [5].

Likewise, the same author states that the characteristics of a good methodology are a recommended level of detail, standardized techniques of planning, temporal determination and cost control, a standardized form of reporting, flexibility to apply to all projects, flexibility for rapid development, user-friendliness, acceptance and usability in the organization, the use of standardized life cycle phases of the project [5].

Similar to the aforementioned definitions, the roles, teams, skills, processes, techniques, tools and standards used by the project team, can be considered as a methodology [6]. It should be noted that the most of the authors cited is of the opinion that if the above is applied by one or two people, it can be considered as a method, but if more people, i.e. the whole team applies the aforementioned, it can be considered as a methodology.
3. ORGANIZATION AND MANAGEMENT OF SURFACE PIT MINE OPENING ACTIVITIES

All the complexity and multidisciplinary nature, which appear in the surface mining of mineral deposits in all the phases, from research and planning to procurement of equipment, mining start, until the closing phase of the surface pit, while respecting the conditions for sustainable development and environmental protection throughout all the phases, indicate a very high risk of surface mining project implementation in all the phases of the project. This risk is particularly emphasized at the stage of making investment decisions concerning the opening of a new surface pit mine throughout all levels, since the technical-technological capabilities and economic viability of the entire implementation of the mining project are decided at this phase of the project.

In addition, a very common situation in the implementation of mining projects is a situation of exceeding the scope of the planned resources for their implementation, particularly the scheduled time and financial investment. Such problems are usually related to the experience of the project team and its team leader managing the entire project, but often represent the result of altering the project scope due to reinterpretation of geological and engineering-geological conditions of the resource deposit.

The main reason for such problems is the approach to the implementation of a mining project, i.e. the method of organizing and managing mining projects, especially in the preparatory stage, where on the basis of technical and economic parameters, as well as other influencing factors, a final decision is made on the project implementation of opening the surface pit mine.

Today, when all the interested parties insist on increasing and more efficient use of the everyday diminishing mineral resources, mining projects are subject to a higher degree of risk and complexity of implementation. Therefore, it is necessary that mining companies pay particular attention to the management of organization and implementation of their projects in order to meet project objectives.

Considering the level of investment in mining facilities, it is certain that, in terms of the risk aspect, the most delicate phase is preparing investment and technical documentation which further determines all the future activities regarding the opening, development and closure of a surface pit mine. In general, this phase includes a series of coordinated activities on the preparation of the following: Scope Study, Study on Geological Resources, Main Mining Project with all the corresponding technical projects, and it determines the technical and technological capacity and economic viability of the entire implementation of a mining project.

Therefore, the approach to the organization and optimization of all the aforementioned activities is very important for the efficient and effective implementation of this phase of the surface pit mine life cycle. Nowadays, it is an increasingly common trend in the world to have large, capital projects, such as mining projects, organized and managed in a project manner in order to perform optimally.

Certainly, the project of opening and developing of a surface pit mine is preceded by previous strategic decisions of the company, from the field of strategic development. Each strategic initiative comes with a large amount of information which are generated and structured, and during project implementation – evaluated, meaning that in terms of the future development of the company they might be of crucial importance. The first and the most delicate phase of the project, in which the strategic visions and decisions are concretised and reformatted is definitely the preparation of an investment and technical documentation which can, undoubtedly, affect the successful implementation of the entire
project. Other phases of the surface pit mine project can be defined as the opening phase, exploitation phase and closing phase.

Given the complexity and implementation time frame, it is required to define the aforementioned phases as separate, dynamically linked multi-projects or projects portfolio. The key difference between a project and a project portfolio is that within the project the activities are managed and all the activities are associated with interdependency, while in the project portfolio, the projects are managed, and all the projects are linked to a single goal.

The aim of project portfolio management is to allow the mining company to be focused, fast and flexible in the implementation of a project through a defined process of decision-making, improved cost control and efficient use of resources. Management of Investment and technical documents project portfolio of a surface pit mine refers to the identification, prioritization, assignment of authorities, control and management of projects, programs and all the other activities with the aim of making a reliable investment and in accordance with the law and professional standards of well composed technical documentation of the surface pit mine.

The first step in the organization of a project portfolio is to have the management of the company identify and examine all the required projects and activities in the stage of preparing the investment and technical documentation of the surface pit mine in order to make decisions on priorities, necessary staff and individual budgets. For making such decisions it is necessary to provide the information about individual projects in a consistent and standard format, as well as the information on the project groups, and finally to all the projects.

Portfolio management is a collective process by itself, in which individuals collaborate in defining project plans, control points, key performance indicators, guidance of the projects started and approval of the projects completed. Establishing of a specialized collaboration system provides significant time saving, enabling instant access to information on the status of individual projects or on the status of individual project activities, by accelerating decision-making and promoting project management cooperation at all levels. Portfolio management, through continuous monitoring and control of project implementation, provides attaining of the planned resources, budget and scope of projects [7].

![Figure 1. Conceptual project portfolio model](image-url)
Typical benefits from the implementation of management process into the entire project portfolio primarily include:

- consistency of planning and budgeting;
- timely action;
- a detailed overview of all the undertaken joint projects and initiatives and related key performance indicators;
- the possibility of periodic synchronisation of initiated and planned projects with the strategic objectives of the company;
- decision making based on the criteria such as risk, profit and contribution determined by business objectives;
- optimizing the use of resources and human resources with the focus on common priorities;
- a guaranteed and centralized access to information critical for the evaluation of projects and decision making at the level of a project, therefore accelerating decision making.

Figure 2. Distribution of benefits to the management from portfolio management at all levels [1]

3.1 Formation of portfolio of investment and technical documentation of surface pit mine opening

Formation of project portfolio includes the identification of projects or groups of projects to be implemented, definition of project teams, authorisations and responsibilities, checkpoints, management and key realization performance indicators. Bearing in mind the complexity of natural, geological, technical, technological and economic conditions for the opening and development of the surface pit mines, it is necessary to implement various types and scope of research in order to select and define optimal solutions which shall represent the basis and guidelines for the development of mining projects.

After confirming the mineral reserves through geological explorations and the Study on geological reserves, surface mining studies are prepared followed by additional
geological, geomechanical, hydrological and hydrogeological research, environment related research, as a supplement to the bases for the preparation of investment and technical documentation.

Previous research performed by conducting studies, aimed at resolving all outstanding dilemmas regarding possible solutions for opening and development of the surface pit mines. Through the solutions from the study the following actions are conducted: optimization of the structure of surface mines, optimisation of surface mines production capacity, selection of the exploitation system and equipment within the exploitation system, selection of location and method of opening and progress of the operations in surface pit mines in the function of the parameters set, of which the lifetime expectancy, capacity and exploitation economics are the most common.

For an optimized solution, a technical documentation is prepared, containing the Major Mining Project with associated technical projects related to the conception of the following: drainage, recultivation, environmental protection, physical security, construction buildings, machine and electrical installations, preparation and processing, transportation, etc.

While performing all the research and preparing the documentation it is necessary to collect a number of requirements and approvals from the relevant government institutions related to the performance of certain works.

By analysing the activities from geological exploration works through making various studies to the preparation of investment and technical documentation and obtaining the necessary permits and approvals, several groups of projects are clearly distinguished.

The first group of projects includes all exploration works (geological, hydrological, hydrogeological, geomechanical, and so on) and the preparation of geodetic bases. The second group of projects includes the preparation of techno-economic studies and environmental impact assessment studies. The third group of projects includes the development of the Major mining project with associated technical projects.

For projects identified in such manner and project groups a corresponding project team is formed on a level of portfolio, consisting of managers of the projects or groups of projects. Project portfolio managers are appointed by the management of the company and he is responsible for the successful implementation of the project, relations between the project organization and the environment within the company and outside the company, and the control of implementation dynamics and budget at the level of the portfolio. The project managers and the managers of project groups comprise a portfolio management and are responsible for the successful implementation of projects, control of dynamics and budget and communication in the domain of their own projects and are supervised by the portfolio manager. The members of the project team are responsible for the successful implementation of project activities assigned to them and are under jurisdiction of the project manager.

Figure 3. displays an example of the portfolio organization model for the projects identified from investment and technical documentation of the surface pit mine opening, made by the author of this paper, based on the lessons obtained from the field of organization and process management as well as from personal experiences.
Figure 2. The organisation of portfolio of the project identified

The completion of the portfolio definition phase is followed by the phase of organizing individual projects in a traditional manner where the following is defined:

- Project scope management,
- Schedule and deadline management
- Project cost management,
- Quality management within the project,
- Human resource management,
- Communications management,
- Risk management within the Project,
- Procurement management,
- Contract management (by outsourcing).

The next phase is the completion of the project portfolio where the required human and material resources are accumulated and optimized, the budgets are accumulated and the individual implementation dynamics are coordinated.

4. CONCLUSION

Management of investment projects of opening surface pit coal mines is essentially a very complex decision-making process conditioned by a large number of input factors, while particularly having geological, economic, and environmental factors as uncertainties, which often carry risks that represent a direct reliability function of such factors. Therefore, it is necessary to apply the „world’s best practice“ in the field of project management, and then perform the economic, geological and ecological analysis and evaluation of the data reliability, which represent the input data, alongside with the use of modern software solutions aimed at defining and optimizing management models of Investment Projects related to opening of surface pit mines.
5. REFERENCES:


