

Conceptual Model for Effective Project Portfolio Management

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ABSTRACT

The modern world, strongly influenced by the ever-changing environment, determines the need for organizations to respond to changing requirements in terms of both the length of the cycle to develop new products and services and the development of competitive advantages. And since the approach of ensuring productivity, through effective management of routine operations in a sustainable organizational structure, it is unable to meet the requirements in an environment of high uncertainty or resource constraints, it is increasingly relevant and the approach to managing change through projects. Along with the knowledge and skills in the area of classical management science (finance, accounting, strategic management, etc.), modern managers should form the ability to project management.

Since the approach to ensure productivity through effective management of routine operations in a sustainable organizational structure, is unable to meet requirements in an environment of high uncertainty or resource constraints, it is increasingly relevant to use the approach of managing change through projects. Along with the knowledge and skills in the area of classical management science (finance, accounting, strategic management, etc.), modern managers should develop the ability of project management. Moreover, managing the portfolio of projects within the project-oriented organization is a relatively new management skill which requires a specific management process and methods. Project portfolio management is linked to the use of a set of knowledge, techniques and methods that support the implementation of the organizational strategy through a complex of integrated projects. This has provoked our scientific quests to analyze some existing and modern approaches that allow attention to reflect real opportunities, synergies and cannibalism in project selection tasks and resource completeness when they are shared between projects in the portfolio. This also defines the purpose of this publication to provide a conceptual model for effective portfolio management.

Keywords: Management; Project Management; Project Portfolio Management.

INTRODUCTION

Project portfolio management is a complex concept that involves a number of key issues, the solution of which is provided by various portfolio management techniques [2].

In project organizations, one of the first problems faced by project managers is the scarcity of resources, a problem that arises even when managing a project whose implementation is directly dependent on them - the resources (financial, material, informational, human) [3] Namely, the availability of resources defines the key features of any project: duration, cost and quality. In theory and practice, popular resource provision techniques are either at the portfolio formation stage or at the implementation stage (operational planning). The second technology, at the implementation stage, is also known as the elimination of conflicts between resources.

Moreover, the lack of resources can lead to a temporary suspension or termination of the project..

It should be considered that resources are insufficient due to their limitations. This is the reason for selecting projects that form a "proper portfolio". This in itself is rather complicated because, apart from the economic efficiency of individual projects, it is also necessary to take into account the compliance of each of them with the chosen strategy. Moreover, the strategic vision of the organization: mission, goals and strategy, without neglecting the participation of top managers and the skills of the project teams, is predetermined by the irreplaceable conditions for the implementation of portfolio management.

In this context, when the second programming period 2014-2020 is already over, and based on the lessons learned from the first programming

period, we are directing our research into exploring the opportunities for effective project portfolio management by creating a conceptual model. This also defines our research objective of the present scientific work.

MATERIAL AND METHODS

In the pre-investment phase of the life cycle of the project, the most important stage is the evaluation of its effectiveness, as the further development of the project is entirely dependent on the results of the analysis of its effectiveness. [4]

The effectiveness of the project is a category that reflects the project's compliance with the goals and interests of its participants. On this basis, the evaluation of the project should be carried out both on the whole project and on each participant. The effectiveness of the entire project is assessed to determine the potential attractiveness of the project for potential participants and the search for sources of funding. This means assessing its socio-economic efficiency and commercial viability.

The notion of effectiveness reflects the attitude of the results obtained (from management, production, transactions, interactions, etc.) and the costs necessary to achieve them. The most commonly used indicators to quickly assess the attractiveness of projects are revenue and expenditure, as well as methods for analyzing the profitability of the project, the return on investment period. At the same time, these indicators have certain shortcomings in terms of allowing the same value of revenue and expenditure over different periods of time.

For the investor, revenues and expenses associated with different time periods have a different value due to the variable value of the capital over the time. [5] The effectiveness of participation in a project is determined in order to verify its feasibility, as well as its interest in all participants. In particular, it should be assessed:

- The effectiveness of the involvement of different organizations in the project;
- Effectiveness of investments in the project;
- The effectiveness of participation in the project structures at a higher level, including: regional and national economic efficiency; sectoral efficiency; financial efficiency.

As the most important principles for evaluating the effectiveness of the project, we can deduce the following:

- Consideration of the project during its entire life cycle (the evaluation of the project effectiveness should be made in the development of: the investment proposal, the investments, the design study and the realization of the project in the form of economic monitoring within the management of the project costs);
- Cash flow modeling;
- Comparability of the conditions of the different projects;
- The principle of maximum effect;
- Observation of the time factor;
- Evaluation of the forthcoming costs and revenues only;
- comparison of the states: " with the project" and "no project";
- Influence of the uncertainty and risk that accompany the implementation of the project;
- The impact of project effectiveness on the need for working capital;
- Taking into account the level of inflation.

The evaluation of the effectiveness of the project takes place in three stages: the first stage is related to an expert assessment of the public significance of the project. Large scale, national and global projects are considered to be of major importance to society;

- The second stage includes the calculation of project performance indicators as a whole. The aim is to make an integrated economic assessment of project solutions at this stage and to provide the necessary conditions for finding an investor. For local projects, only their economic effectiveness is assessed, and if it is acceptable, it is recommended to go directly to the third evaluation step. For socially significant projects, the assessment of their socio-economic effectiveness is of paramount importance. Where the assessment is unsatisfactory, such projects are not advisable to implement and cannot rely on grants from the state budget;
- The third stage of the evaluation is carried out after developing a funding scheme. At this stage, the composition of the participants, the financial feasibility and the effectiveness of each project's participation in each project (regional and sectoral

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efficiency, efficiency of participation in the project of individual companies and shareholders, economic efficiency, etc.) is

determined at this. The algorithm for evaluating project effectiveness is presented in Fig.1.

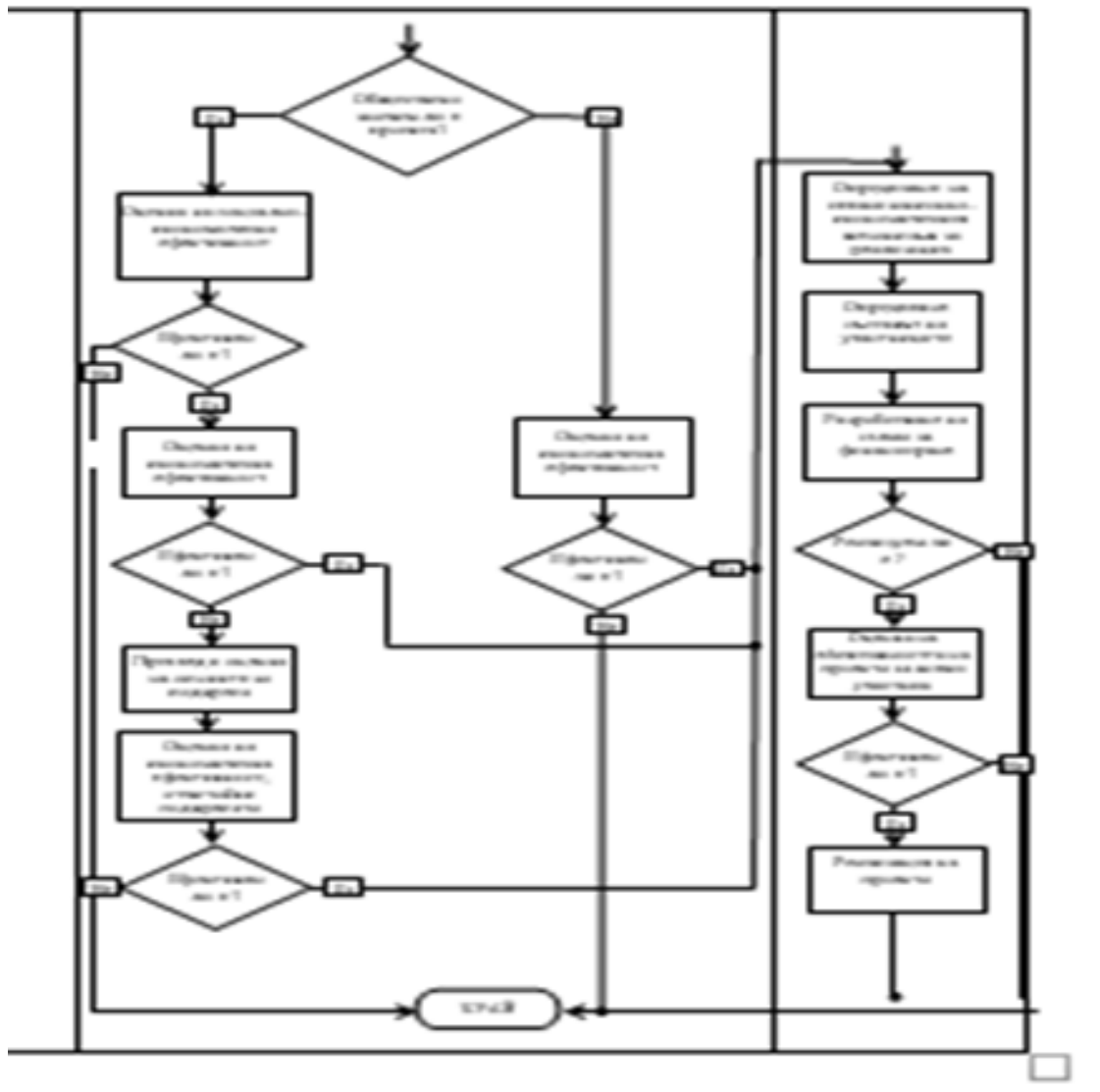


Figure1. Algorithm for evaluating project effectiveness

In line with the organization's specific strategy, a maximum number of project variants is developed for each estimated portfolio of projects. The project effectiveness assessment stage is preceded by portfolio formation: obviously ineffective projects are rejected and the number of alternatives for each business line is reduced. Alternative project variants differ from each other on implementation strategies, assets used, participants, etc.

In this case, the task of selecting a project from multiple alternatives is a task of maximizing the target performance criterion $F(s)$. Formally, this task can be represented as follows:

$$F_{(s)} \rightarrow \max, s \in S, \quad (1)$$

where S is the vector of possible strategies. [155]

The process of selecting and evaluating the effectiveness of projects is explored in stages, which are presented in Fig. 2.

Thus, at the pre-selection phase of projects, the deliberately ineffective ones are removed. At this stage, instead of the maximum target criterion function, it is appropriate to use a certain threshold value for the performance criterion: where S is the vector of possible strategies. [155]

$$F_{(s)} \geq D, s \in S_d, \quad (2)$$

Where D is a real number, and S_d is a subset of the S set.

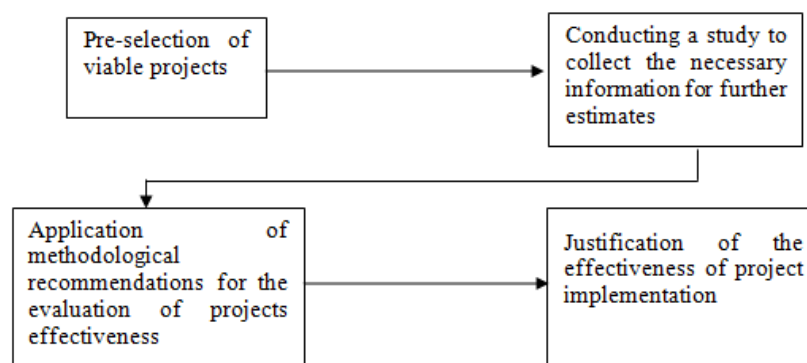


Figure2. Stages in the evaluation of project effectiveness

The next stage analyzes the most competitive projects. There are several effective project evaluation techniques based mainly on a single methodological basis and differing mainly in relevance and subject areas.

When evaluating the effectiveness of projects, it is recommended to use the following features:

- Net value (NV);
- Net Present Value (NPV);
- Internal Rate of Return (IRR);
- Cost and investment return index;
- Discounted payback period - Payback Period (PP).

The net present value is the difference between the present value of the cash flows discounted according to the selected percentage and the amount of the initial investment. The positive value of NPV can be considered as a confirmation of the appropriate investment of financial resources in a project and the negative value is a signal of inefficiency. [14]

$$NVP = \sum_{i=1}^n \left(\frac{F_i}{(1+r)^i} - K \right) \quad (3)$$

$$F_i = P_i - 3_i,$$

as: i - number of the period;

n - Duration of the project in periods;

F_i - Cash flow;

r - Discount rate;

K - The amount of the initial investment;

P_i . The economic outcome of the project within the period;

3_i . The economic outcome of the project in the period i .

When the project involves repeated investments over several periods, the formula looks like this:

$$NVP = \sum_{i=1}^n \frac{F_i}{(1+r)^i} - \sum \frac{K_i}{(1+r)^i} \quad (4)$$

$$F_i = P_i - 3_i$$

It should be noted that the net present value is absolute. It shows the economic benefit to the organization of the realization of this project. But it does not give an idea of how much the cost is, the usefulness and the efficiency of what the funds are spent on. In cases where the financial resources for investments are limited, it is recommended that projects with the highest net present value be selected. When there are sufficient project variants and financial options are limited, it is recommended to use relative indicators, such as an internal rate of return.

The internal rate of return determines the maximum acceptable discount rate at which it is possible to invest funds in the project without incurring losses to the owner (the investor). The Internal Rate of Return (IRR) is determined by solving the following equation:

$$\sum_{n=1}^N F_n \frac{1}{(1+IRR)^n} = \sum_{n=0}^N K_n \frac{1}{(1+IRR)^n} \quad (5)$$

When the project involves more than one single investments and consists of consecutive investments over several periods, the formula becomes as follows:

$$NPV = \sum_{n=1}^N F_n \frac{1}{(1+r)^n} - \sum_{n=0}^N K_n \frac{1}{(1+r)^n} \quad (6)$$

The project is considered effective if the internal rate of return is above the desired yield, otherwise it is ineffective. The benchmark has two disadvantages. The first is that it overestimates highly profitable projects, since its calculation implies that the positive cash flows from investments are reinvested at an amount equal to the internal rate of return on the

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project, which seems unlikely. The second disadvantage is due to the fact that the solution of the above equation can give several values of the internal rate of return. These deficiencies can be remedied by calculating the index of the modified internal rate of return - Modified Internal Rate of Return (MIRR).

$$\sum_{n=0}^N K_n \frac{1}{(1+r)^n} = \frac{\sum_{n=1}^N F_n (1+r)^{N-n}}{(1+MIRR)^N} \quad (7)$$

The evaluation of the project effectiveness is made by comparing the calculated MIRR with r : $MIRR > r$ - the investment is assessed as effective from the financial point of view; $MIRR = r$, the investment is at the minimum efficiency limit; $MIRR < r$, the investment is assessed as ineffective.

Along with the above, the following indicators are used to assess the effectiveness of the projects:

- Profitability Index;
- Efficiency of investments factor;
- Financial Management Rate of Return. [13]

In practice, when assessing the effectiveness of the projects, in the quality of the target indicators, the net present value or the internal rate of return is adopted, and the payback period serves as an additional limit. In this regard, when assessing the effectiveness of the project, its relevance to stakeholders should be assessed under the given conditions.

It should be noted that some methods for evaluating the effectiveness of projects do not take into account the specificities of portfolio management of projects, i.e. the focus of the portfolio of projects to achieve the organization's strategic goals. These techniques only reflect one component of the project - the financial one - and do not take into account the other performance criteria.

The main challenge for the management of the organization and the project management team is to develop a system of criteria on which the different projects should be evaluated when deciding on the inclusion of a project in the portfolio. This system of criteria must meet the following requirements:

- Reflect the significant and measurable characteristics of the projects;

- Reflect the strategic goals of the organization that implements the portfolio of projects and to take account of forecasted and expert information;
- Allow to harmonize the variety of views of the actors (managers, different units, etc.) as their views on the importance of one project or the organization's strategic goals may differ.

RESULT AND DISCUSSION

Creation of a Project Portfolio

In the theory of project management, key concepts are: project, programme, portfolio. Among the concepts, the programme and the portfolio of projects have significant differences due to the fact that all projects of the programme are subject to a specific strategic goal, while the portfolio can consist of different projects with different purposes. Thus, the programme is often treated as a major project (multiproject or macro project). But unlike the project, it is not necessary that the program has an end date.

A portfolio is a set of projects or programmes and other joint activities to effectively manage these activities in order to achieve the strategic goals of an organization.

The portfolio itself can be of two types: independent simultaneous execution projects (which is why it is called a portfolio) and network - a set of interconnected projects - some projects can only start after completion of certain stages of other projects and influence the startup solutions for next projects. Project management institute (PMI) creates two standards that complement the knowledge base for program management and the portfolio of projects (of PMBoK, guidelines and standards). Of course, both standards are based on model-based management.

The portfolio management standard distinguishes two groups of processes: coordination and harmonization, monitoring and control. The first group of processes includes choosing the contents of the portfolio, which categories and components will be evaluated and selected for inclusion in the portfolio. The monitoring and control processes group includes periodic verification of the performance indicators of the organization's strategic goals. [7]

On this basis, the following main classifications of project portfolio creation tasks can be introduced:

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- Dependency of the projects according to which independent projects (for which there are no constraints regarding the start-up sequence and their implementation, except for the resource constraints) and dependent projects (for which a network schedule was created, illustrating the admissible consistency in the implementation of the projects);
- Invariantness of the portfolio according to which the project portfolio is predetermined or should be formed;
- Ability to solve the problem, on the basis of which the solution of the problem requires the allocation of resources and / or search for a starting point of the project implementation.

In theory and practice, the identified classes of optimization tasks used in the project portfolio modeling are associated with: resource allocation tasks and tasks for selecting the start time of operations. The last class of tasks as a whole should determine the sequence of execution (to be more precise - the starting time of of implementation) of a particular set of projects. The most detailed of them examines the problem of minimization of lost profits and self-financing.^[102] Through a multi-criteria model of the project portfolio, the degree of compliance of the project portfolio with the organization's strategic objectives is formally defined.

By summarizing the different views on portfolio management, three main tasks can be distinguished within the project-oriented organization.

- Selection of a complex of integrated projects whose goals correspond to the organizational strategy;
- Defining the priorities within the complex and allocating the resources of the individual projects to ensure integration;
- Evaluation of the project portfolio - its total value, its internal balance, its key parameters and its consistency with the strategic objective of the organization.
- In line with this [8], with regard to the management of the project portfolio, the hierarchical relationship between the strategy, the project portfolio and the individual projects in the portfolio can be derived. This relationship reflects, in general, the role and importance of managing the project portfolio in its capacity as:

- A tool for realization of the organizational strategy; process of transformation into a project form of the organization's business strategy;
- A tool for monitoring and controlling the overall risk of the project portfolio;
- An instrument to optimize the allocation and targeting of resources to individual projects.

This hierarchy can be presented in more detail in the overall management framework of the project portfolio, covering the four stages of this process - preparation, evaluation, project selection and integration into the portfolio. They exist identically in project-oriented organizations, regardless of the approach used to manage the project portfolio.

The model representing the project portfolio management process provides opportunities to optimize the performance of the portfolio as a whole, not just the individual projects. This model provides a common logical framework for project portfolio management and assists managers in portfolio decision-making (evaluating and selecting appropriate projects in the process of project prioritization) by structuring the activities in the relevant stages. [9]

Planning the Implementation Process of the Project Portfolio

The term "plan" has a lot of meanings, and it often incorporates different content. The project implementation plan is different from the functional plans, such as the production plan, the material and technical supply plan, the financial plan, etc. It is noteworthy that it is more complex in character, meaning that it contains a complete set of aims and objectives, relevant detailed activities and actions to achieve the main aim (mission) of the project. [10]

The essence of the process of planning the implementation of the project portfolio is to define objectives and ways to achieve them by establishing a set of events and activities to be implemented, implementing the methods and means for their achievement, the providing the resources required for their implementation, coordination of the actions of the participants in the project.

At the planning stage, all necessary parameters for the portfolio are determined: duration of each of the monitored elements of the portfolio, the need of human, material and technical resources, time for raw material supply, materials and technological equipment, deadlines and

volume of subcontractors' engagement. Project portfolio planning processes and procedures should ensure that the portfolio is realized within a certain timeframe with minimal costs, within the target cost and resources of the appropriate quality.

In general, the task of planning the implementation process of the project portfolio is limited to the planning of independent (in general) projects which are to be included in it. Project planning tasks are well-developed and widely disseminated in literature. They are established before the start of the project and are limited to defining, on the basis of all the available information at a given moment, the optimal target values of the control parameters and, respectively, the status of the project for the entire planned period for its implementation.

It is appropriate to outline the following classification of planning mechanisms in the organizational system:

- Mechanisms for resource allocation;
- Mechanisms of internal pricing;
- Mechanisms of competition;
- Mechanisms for active expertise. [4]

Using the mechanisms of active expertise in the planning process can significantly improve the effectiveness of the project. The essence of this mechanism is to obtain and process information on the main features of the project and its surrounding environment by experts in specific areas.

The internal pricing mechanisms address the problem of redistribution of project activities and the results achieved by project implementation (in principle they can be measured in monetary terms) among project participants. The general idea of each contest is to have the candidates ranked on the basis of the available information and then to determine the winner (or winners) ranked first (or, respectively, the first few places, depending on the conditions of the competition). In this case, a problem may arise from the fact that contestants can hand over manipulated information in order to favor one of the winners.

Distribution of Resources between Projects in the Portfolio

An efficient portfolio management model implies an efficient allocation of resources. The latter leads to both efficiency gains and shorter implementation times for portfolio projects. In

turn, by shortening the time to complete innovative portfolio projects, the organization strengthens the competitive edge. [5]

The allocation of resources to projects (or to project phases) in many cases leads to a change in their duration, both at the level of the expected values and the distribution parameters.

Project portfolios are characterized by the fact that it is essential for them to miss out on the interests of the managers of the organization that are responsible for the implementation (or are interested in the implementation) of one or other projects (we will continue to refer to them as project managers) and the owners of resources needed to implement projects. For this reason the problem arises of building a resource allocation model between projects entering the portfolio that would allow the interests of all stakeholders to be reconciled.

For this purpose, first a general description of the model is given, a task for optimal allocation of resources within a centralized system is formulated, without taking into account the interests of the project managers and project managers. Next, the solution to this task (efficiency of resource allocation) is compared with the efficiency of using a scheme that takes into account the interests of the participants and the efficiency of introducing internal company prices for the use of the organization's resources in the implementation of the portfolio of projects.

The results obtained show that if it is possible to harmonize the interests of project managers, the allocation of resources proposed within a centralized system is also possible. It should be borne in mind that this does not mean the coherence of any centralized decision on the allocation of resources between projects in the portfolio. A private but fairly common case is the use of the so-called transfer pricing that determines the cost of using the unit project from one resource or another. Practice has shown that the use of the centralized allocation scheme among portfolio projects is equivalent to the use of a transfer pricing system that meets certain conditions. However, for an optimal allocation of resources there may not be an equivalent transfer pricing system. [6]

The resource constraint may have an impact on the function of costs, along with the ability to purchase resources (borrowing) outside of the organization in question. Discretionality of the task - obtaining a non-zero income from the

realization of the project only if it has been allocated not less than a certain total amount of resource or resources in a given completeness - requires it to be taken into account in the function of income, etc.

Operational Portfolio Management

Operational management is realized in the course of the project and is to determine (based on all current information) the optimal current and future values of the control parameters, i.e. the optimal "planning" meanings of the control parameters and, respectively, the state of the projects until the end of the planned implementation period. [12]

This means that the planning and operational management tasks are individual cases of the same management task, differing only on the information available at the time of decision making. In fact, a multiproject, which consists of many technology and resource-related projects, requires solving the aggregation problem - for example, assessing the state of the project, based on detailed information on the status of the sub-projects and activities. The solution to this problem is not trivial. At the same time, the projects included in the portfolio carried out by an organization are usually technologically independent. Reporting only on resource relatedness is easier than on both resource and technology. However, it is necessary to assess the state of the portfolio in terms of the objectives of the organization. [11]. And this requires the use of volume absorption indicator - the most widely used tool to assess the progress of projects and their operational management so far. It is assumed that the main feature of the volume utilization methodology is the possibility of "early detection" (discovery of the early stages of the project) of inconsistency between the actual performance indicators of the project and the expected results of the project (terms, costs etc.) and taking timely corrective actions until the project is terminated.

Planned and actual (current) values of financial indicators allow to describe the performance dynamics of the project portfolio from the point of view of the organization as a whole. The comparison of the planned and the actual absorbed amount and the expended funds can serve as a basis for making effective operational management.

CONCLUSION

Using project portfolio management in the activities of modern organizations is an effective management method that allows rapid response

to changes in external requirements and the achievement of strategic goals of the organization with minimal resource costs. The proposed conceptual model for efficient project portfolio management allows us to evaluate the effectiveness of implementing different project portfolios in terms of strategic goals of the organization. It also describes the procedures for harmonizing the interests of stakeholders and examines the consequences of manipulating them with information.

A prospective direction for further research is the synthesis of the results of the coordination of interests in the case of a non-monotonous function of the assessment of the project effect. For its completeness it is expedient to develop models and methods for resource allocation and timing for implementation of technology-dependent projects in the process of solving the problem of portfolio formation, which provides us with a field for our future scientific research.

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