

The Basics of the Project Portfolio Management Generalized Body of Knowledge

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Abstract

Several experts' surveys show that the success indicators of a new product in the market have a strong positive correlation with the performance of project portfolio management in organizations, and the success of the project is strongly related to the maturity of portfolio management.

At the same time, it is noted that the existing portfolio management methodologies do not sufficiently consider the interaction of a potential project with an existing portfolio in terms of cash flow, schedule, or risk.

To effectively manage a project portfolio, an organization can take the path of forming its management approach. To meet this challenge, it requires complete and well-structured information on existing standards and guidelines for project portfolio management. The proposals described in the literature and the views of experts on the components of an effective approach should also be considered. To select or develop an approach to portfolio management, it is proposed in this work to create a project portfolio management generalized body of knowledge. The structure and mathematical model of such the body of knowledge have been developed. Information on five common standards and portfolio management guides are added to the body of knowledge. A method is proposed for choosing an approach for managing a projects portfolio based on optimizing risks and management cost.

Keywords 1

Project portfolio management, approach, body of knowledge, method for choosing

1. Introduction

In recent decades, there has been a rapid development of managing organizations' projects portfolios methods. Several standards and guidelines in this area [1, 2, 3, 4] have become widespread around the world. Scientists from different countries conducted surveys of respondents on the impact of portfolio management on business. Studies [5] have shown that the success indicators of a new product on the market have a strong positive correlation with the performance of project portfolio management in organizations. Also, the effectiveness of project portfolio management was assessed against six indicators [5, 6]. These indicators include: the degree of consistency of the portfolio with the company's goals and strategy, how much the portfolio of new product projects contains only business-valuable projects, how much the allocation of resources in the project portfolio really reflects the business strategy, how projects are executed on time, to which extend the projects portfolio of new product has an excel-lent balance in terms of long-term and short-term perspective, the high and low risks for markets and technology, how far the number of new product projects matches the available human, time and money resources.

The authors [7, 8] analyzed the impact of portfolio management on project success. As a result of processing the expert survey data, it was found that there is a positive correlation between the

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application of project portfolio management and project success. A strong positive correlation coefficient was noted between the level of maturity of project portfolio management and project success.

It was shown in [9] that managing a portfolio of projects had a significant impact on the market share of business organizations in Nigeria. In addition, effective portfolio management has had a positive impact on the capital growth of these business organizations.

In [10], it was noted that existing portfolio management methodologies focus on the consistency of the portfolio with the organization's strategic objectives and financial results. At the same time, insufficient attention is paid to the impact of the project, which is added to the portfolio, on portfolio risks, capital costs, cash flows, time-tables, resource allocation. It is proposed [10] to create new methodologies for managing project portfolios that will bridge the gap between the strategic focus of the portfolio and the operational activities of managers to agree on the mutual influence of projects on risks, capital costs, cash flows, schedules, and resource allocation.

Project portfolio management is one of the most important management functions in today's enterprise. The success of achieving the strategic goals of the enterprise depends on the approach taken to manage the portfolio of projects. By the approach to managing a portfolio of projects we understand the methodology of managing a portfolio of projects, supplemented by methods and tools for performing processes, document templates. By the project portfolio management methodology, we mean a defined and documented system of principles, rules, processes, practices, life cycle, organizational structure, and prescribed roles that provide project portfolio management in the organization [11]. The concept of portfolio management methodology is highlighted to refer to the fundamental components of the approach. These components are often determined by the chosen standard or portfolio management guide [1, 2, 3, 4]. These components in an organization are supplemented by methods of implementation of certain processes, portfolio management tools, document templates.

When implementing project portfolio management, each organization is faced with the problem of choosing an existing approach from known approaches or forming its own approach, with consideration to its specificities and environment. For both the first and second tasks, structured information about existing standards and guidelines in this area are needed. The suggestions from literature and experts' opinions on the components of an effective approach should also be considered. To this end, it is advisable to create a generalized body of knowledge on portfolio management.

Thus, the purpose of the article is to create the basics of the project portfolio management generalized body of knowledge. In this article, we will focus on traditional approaches to portfolio management. Because, according to the survey results [12], 56% of organizations use traditional approaches to project management, 22% of organizations use Agile approaches, and 19% of organizations use hybrid approaches. In IT, 33% of organizations use Agile approaches, and 22% of organizations use hybrid approaches. 3060 project professionals from all over the world have taken part in the survey. Among the analyzed organizations, 17% were IT companies. Due to the widespread prevalence of traditional approaches in project management, including the IT industry, we will begin to create the generalized body of knowledge on portfolio management, starting with traditional approaches.

2. The Structure of a Generalized Body of Knowledge on Project Portfolio Management

The structure of the generalized body of knowledge on project portfolio management is proposed.

It includes principles, processes, practices, life cycles, organizational structures, defined roles, from common standards, portfolio management guides, publications in this area, considering the opinions of experts [1-4, 13].

The difficulty of creating the generalized body of knowledge is that well-known standards and guidelines differ significantly in the principles and structure of the presentation of materials, in the principles, processes, and practices of managing a portfolio of projects, in the proposed life cycles of

management, organizational structures, and prescribed roles. Most of these standards don't describe the portfolio management processes.

The structure of the developed generalized body of knowledge is shown in Fig.1.

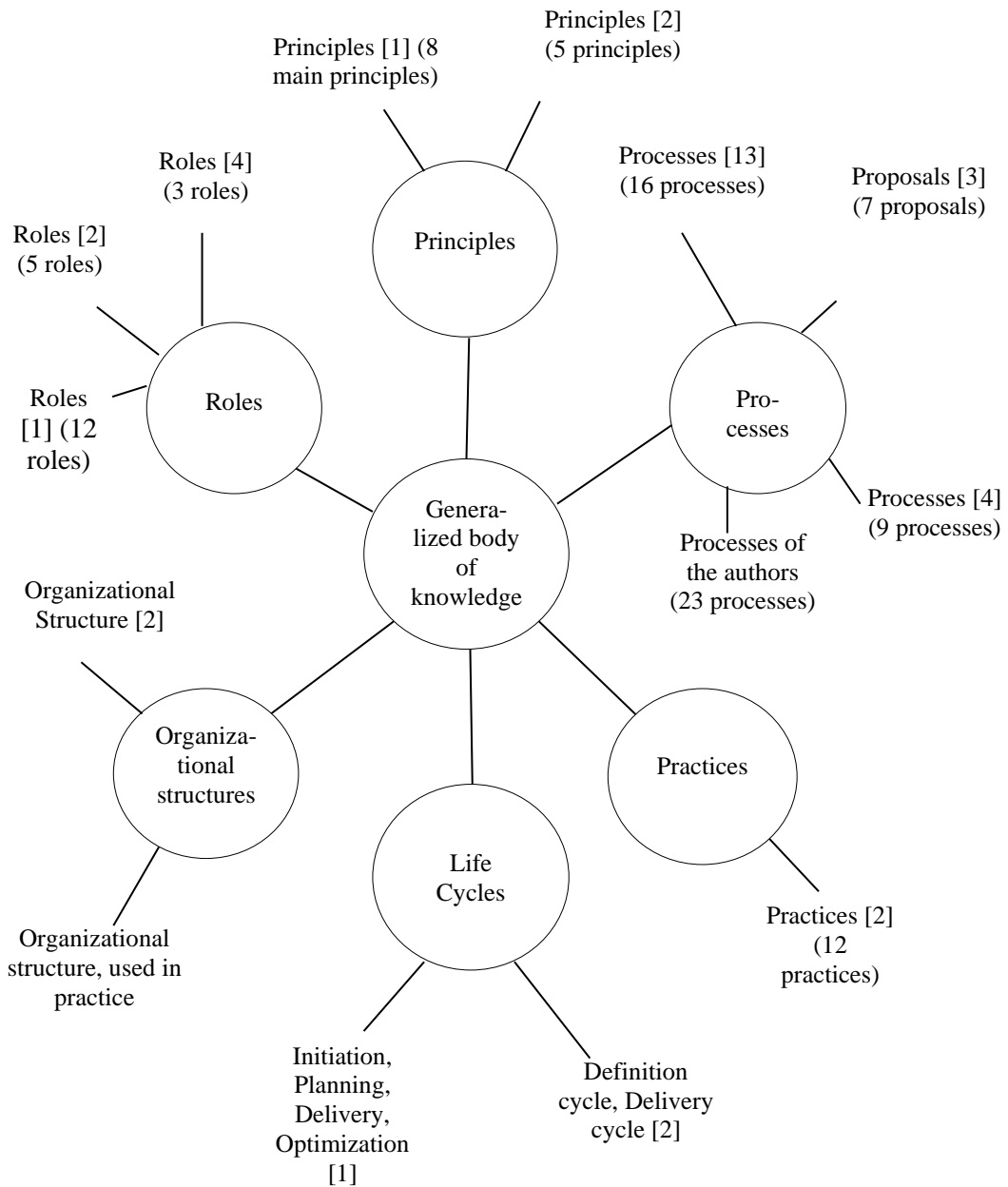


Figure 1: Structure of the project portfolio management generalized body of knowledge

The structure of the project portfolio management generalized body of knowledge can be specified in the form of a set $G = \{P, Z, Q, L, O, R\}$, where P - is the set of principles of portfolio management, in this case $P = \{P^{[2]}, P^{[3]}\}$, $P^{[2]}$ - 8 principles of the standard [1], $P^{[3]}$ - 5 principles of the guide [2], Z - is the set of the project portfolio management processes, $Z = \{Z^{[1]}, Z^{[4]}, Z^{[5]}, Z^{[a]}\}$, $Z^{[1]}$ - 16 processes of the standard [13], $Z^{[4]}$ - 7 proposals of the standard [3], $Z^{[5]}$ - 9 processes of the standard [4], $Z^{[a]}$ - 23 processes, proposed by the authors, Q - is the set of practices, in this case, these are 12 practices described in the guide [2], L - is the set of life cycles, $L = \{L^{[2]}, L^{[3]}\}$, $L^{[2]}$ - life cycle in accordance with the standard [1], consisting of the phases of initiation, planning, execution,

optimization, $L^{[3]}$ - the life cycle in accordance with the guide [2], including the definition cycle and the delivery cycle, O - is the set of types of organizational structures, $O = \{O^{[3]}, O^{[p]}\}$, $O^{[3]}$ - the organizational structure proposed in the guide [2], $O^{[p]}$ - the organizational structure used in practice, R - is the set of roles, $R = \{R^{[2]}, R^{[3]}, R^{[5]}\}$, $R^{[2]}$ - 12 roles described in the standard [1], $R^{[3]}$ - 5 roles proposed in the guide [2], $R^{[5]}$ - 3 roles provided by the standard [4].

It should be noted that the standard [13] can be represented in the body of knowledge by the set $G^{[1]} = \{Z^{[1]}\}$, the standard [1] – by the set $G^{[2]} = \{P^{[2]}, L^{[2]}, R^{[2]}\}$, the guide [2] – by the set $G^{[3]} = \{P^{[3]}, Q^{[3]}, L^{[3]}, O^{[3]}, R^{[3]}\}$, the standard [3] – by the set $G^{[4]} = \{Z^{[4]}\}$, the standard [4] – by the set $G^{[5]} = \{Z^{[5]}, R^{[5]}\}$. This view allows us to conclude how fully the listed standards and guidelines cover the project portfolio management methodology.

3. Principles of Portfolio Management

Let's consider the principles of portfolio management proposed in [1, 2].

The standard [1] contains the following main principles of portfolio management:

- Strive to achieve excellence in strategic performance;
- Enhance transparency, responsibility, accountability, sustainability, and fairness;
- Balance portfolio value with overall risks;
- Ensure that investments in portfolio components are aligned with the organization's strategy;
- Obtain and maintain the sponsorship and engagement of senior management and key stakeholders;
- Exercise active and decisive leadership in optimizing resource utilization;
- Foster a culture that embraces change and risk; and
- Manage complexity to enable successful outcomes.

The guide [2] proposes five principles for portfolio management.

Portfolio Management Principle 1: Senior management commitment.

This principle assumes that senior management should create a decision-making structure in accordance with the organization's strategy, provide a mechanism for determining priorities for the portfolio in accordance with business goals, and demonstrate commitment to change.

Portfolio Management Principle 2: Governance alignment.

The principle of governance alignment is that roles should be clearly defined in relation to portfolio management, portfolio management should be consistent with the broader organizational structure of management, and the process of escalation of problems should be agreed upon. Meeting schedules of governing bodies should also be agreed.

Portfolio Management Principle 3: Strategy alignment.

This principle means that the allocation of funds through various types of initiatives and individual initiatives reflects the relative importance of the organization's strategic objectives and the expected contribution of the initiatives to these objectives.

Portfolio Management Principle 4: Portfolio Office.

This principle defines the key services of the portfolio management office.

Portfolio Management Principle 5: An energized change culture.

This principle implies:

- senior management commitment, communication and motivation;
- mutual and common desire to succeed based on the effective involvement of employees;
- effective management with an appropriate level of bureaucracy;
- culture and behavior reflect an orientation towards the common good and success of the organization, and not towards the interests of individuals.

A comparison of these principles (Table 1) shows that the standard [1] pays more attention to the criteria and ways to achieve the goal, while the guide [2] emphasizes the importance of portfolio management office services.

4. A Generalized Table of Processes

A generalized table of processes for the portfolio management body of knowledge has been developed.

As a basis for creating this table of processes, the standard [13], which is process oriented was used. Guidelines and standards [1, 2, 3] are not process-oriented.

The following process groups are proposed for the generalized process table: “determination of goals and criteria, management principles, methods for achieving goals, resources, appointment of a portfolio manager”, “preliminary selection of components”, “balancing (optimization) of a portfolio”, “authorization of components”, “monitoring and control (accounting and forecasting, control, analysis, decision making)”, “closing of components”).

This table proposes to leave the standard [13] areas of knowledge: Portfolio Strategic Management, Portfolio Governance Management, Portfolio Performance Management, Portfolio Communication Management, and Portfolio Risk Management.

Table 1

The comparison of principles

Areas	The principles of portfolio management proposed in [1]	The principles of portfolio management proposed in [2]
Organization of work of portfolio managers	Enhance transparency, responsibility, accountability, sustainability, and fairness Exercise active and decisive leadership in optimizing resource utilization	Senior management commitment
Engagement of key stakeholders	Obtain and maintain the sponsorship and engagement of senior management and key stakeholders	Governance alignment
Alignment with the strategy	Strive to achieve excellence in strategic performance Ensure that investments in portfolio components are aligned with the organization’s strategy	Strategy alignment
Office organization Commitment to change	Foster a culture that embraces change and risk	Portfolio Office An energized change culture
Criteria	Balance portfolio value with overall risks	
Ways to achieve goals	Manage complexity to enable successful outcomes	

The processes of the standard [13] are presented in a generalized table. When applying the proposed table, the processes [13] “Develop Portfolio Charter”, “Manage Strategic Change”, “Manage Supply and Demand”, “Manage Portfolio Value”, “Manage Portfolio Information”, “Manage Portfolio Risks” were simultaneously found in several cells , which indicates a certain ambiguity of these processes presented in this view.

As already noted, the ISO 21504: 2015 standard [3] is not process-oriented. It suggests what should be done when managing a portfolio without a description of the inputs and outputs. There is no division of these proposals into groups of processes and areas of knowledge. The proposals of the standard [3] were also presented in the form of processes in a generalized table.

As a result, it turned out that such proposals as “Assessing and selecting portfolio components”, “Validating portfolio alignment to strategic objectives”, “Balancing and optimizing the portfolio” appeared simultaneously in several areas of knowledge or process groups, which indicates a certain ambiguity of these proposals. In the description of these sentences, actions cover more than one area of knowledge or a group of processes.

The standard [4] contains a description of 9 portfolio management processes, divided into 3 groups of processes:

- a) a portfolio management process group, including
 - the process of collecting information about the conditions, limitations and requirements for the project portfolio;
 - the process of formalizing management procedures and project portfolio assessment parameters;
- b) a group of processes for forming a portfolio of projects, including
 - the process of identifying portfolio components;
 - the process of evaluating portfolio components;
 - the process of prioritization;
 - the process of optimizing and balancing a portfolio of projects;
 - the process of authorizing a portfolio of projects;
- c) a group of processes for monitoring and controlling the portfolio of projects, including
 - the process of monitoring the implementation of the portfolio of projects;
 - change management process.

These processes are presented in a generalized table.

Along with the sets of processes described in the above documents [3, 4, 13,], a set of portfolio management processes is proposed, which, in our opinion, meets the requirements of many organizations. This set includes both well-known processes and those proposed by us (Table 2, Table 3).

5. Practices in Portfolio Management

One of the documents under consideration, namely the guide [2], contains a description of portfolio management practices that correspond to the phases of the portfolio life cycle.

The definition cycle provides for 5 practices: Understand, Categorize, Prioritize, Balance, and Plan.

The delivery cycle defines 7 practices: Management control, Benefits management, Financial management, Risk management, Stakeholder engagement, Organizational management, and Resource management.

6. Portfolio Management Lifecycles

Two of the five documents under consideration offer portfolio life cycles.

The standard [1] proposes a portfolio life cycle, which consists of 4 stages: Initiation, Planning, Execution and Optimization. Instead of processes, it describes what needs to be done, what documents to prepare.

The portfolio life cycle, according to the guide [2], consists of the definition cycle and the delivery cycle of the portfolio.

7. Organizational Structures of Portfolio Management

The guide [2] proposes a variant of the organizational structure of portfolio management. The components of the organizational structure [2] are not presented in the form of a graph, which would facilitate understanding of the relationships and subordination of participants. This variant is indicated optional. The organizational structure includes: Portfolio direction group / Investment committee, Director of change, Chief executive, Commercial director, Directors, Portfolio progress group /

Change management committee, Director of change, Portfolio and portfolio office management, Senior resource management, Senior program and project management, Senior business as usual management, Program and project management forum, Program and project management, Portfolio office, Portfolio hub / Program and project office.

Table 2
The proposed processes

Knowledge Areas	Process Groups			
	Determination of Goals and Criteria, Management Principles, Methods for Achieving Goals, Resources, and Appointment of a Portfolio Manager	Preliminary Selection of Components	Balancing (Optimization) of a Portfolio	Authorization of Components
Portfolio Strategic Management	1. Development and approval of the charter of the portfolio 2. Development of a portfolio management plan	3. Preliminary selection, evaluation and categorization of potential components	4. Portfolio optimization within the categories and the whole portfolio	5. Component authorization.
Portfolio Performance Management	11. Development of a portfolio performance management plan	12. Evaluation of the effectiveness of potential components		
Portfolio Communication Management	14. Development of a plan for interaction with stakeholders	15. Exchange of information with stakeholders in the process of the preliminary selection of components	16. Exchange of information with stakeholders in the process of portfolio optimization	
Portfolio Risk Management	21. Developing a risk management plan	22. Risk assessment of potential components		

8. Roles in Portfolio Management

When managing a portfolio in accordance with the standard [1], the following roles are considered:

Portfolio manager, Sponsors, Portfolio governance body, Portfolio, program, and project management office (PMO), Portfolio analyst, Program managers, Project managers, Change control

board, Program and project team members, Subject matter experts, Business analysts, and Functional managers in charge of portfolio operations.

The guide [2] defines the following roles in managing a portfolio of projects: portfolio direction group or investment committee; portfolio progress group or change delivery committee; business change director or portfolio director; portfolio manager; portfolio benefits manager.

The standard [4] considers the following roles in managing any project portfolio: project portfolio management committee, portfolio manager, project portfolio management office.

Table 3
The proposed processes (continued)

Knowledge Areas	Process Groups				
	Monitoring and Control				Closing of Components
	Accounting and forecasting	Control	Analysis	Decision making	
Portfolio Strategic Management	6. Portfolio performance accounting and forecasting	7. Portfolio monitoring	8. Analysis of portfolio performance	9. Decision making	10. Component closure
Portfolio Performance Management	13. Monitoring and managing portfolio performance				
Portfolio Communication Management	17. Exchange of information with stakeholders on the results of accounting and forecasting portfolio performance	18. Exchange of information with stakeholders on the results of monitoring portfolio performance.	19. Exchange of information with stakeholders on the results of portfolio performance analysis	20. Exchange of information with stakeholders on the decisions taken	
Portfolio Risk Management	23. Portfolio risk monitoring and management				

9. Choosing an approach for portfolio management

Implementing portfolio management for an organization involves choosing a portfolio management approach from existing approaches or creating your own option. The project portfolio management generalized body of knowledge proposed in this paper can help an organization create its own approach, as it contains structured information about the most requested standards and guidelines. In the future, it is planned to replenish the body of knowledge with information about other existing approaches, including Agile ones. However, the problem of choosing the best possible approach remains unresolved. Traditionally, it is solved heuristically by the leading specialists of the organization based on their experience and intuition. For a more objective and formalized solution to this problem, the choice can be made by using two criteria: the quality of project portfolio management and the cost of project portfolio management. Let's consider these criteria in more detail.

One of the indicators that can characterize the quality of an approach to project portfolio management are the risks inherent in this approach when managing an organization's project portfolio in specific conditions. The lower these risks are, the more qualitative is the approach applied.

To assess the potential risks of the j -th approach to project portfolio management, $j = \overline{1, J}$, J -the number of approaches under consideration, it is proposed to use the generalized table of project portfolio management processes (Table 2 and Table 3) [13].

Each cell of the generalized process table corresponds to a specific knowledge area and a group of project portfolio management processes. It may or may not contain a management process. Each such cell is assessed in terms of the consequences of the risks arising from the failure to carry out the process that may be in this cell. The consequences of potential risks $s_{jk}, k = \overline{1, K}$, it is proposed to evaluate on a five-point scale, K is the number of processes in a generalized table, $K = 36$. The maximum score "5" corresponds to the maximum negative consequence of the risk. The following grading system can be adopted:

5 points - disastrous consequences for the organization,

4 points - the loss of very significant benefits for the organization, which will make it difficult to achieve its strategic goals,

3 points - loss of noticeable benefits for the organization,

2 points - loss of benefits that will not affect the achievement of the organization's strategic goals,

1 point - insignificant loss of benefits for the organization.

Tables 4 and 5 show the authors' estimates of potential risks.

Table 4

Consequences of risks arising from non-execution of the process

Knowledge Areas	Process Groups			
	Determination of Goals and Criteria, Management Principles, Methods for Achieving Goals, Resources, and Appointment of a Portfolio Manager	Preliminary Selection of Components	Balancing (Optimization) of a Portfolio	Authorization of Components
Portfolio Strategic Management	5	4	5	3
Portfolio Performance Management	4	3	-	-
Portfolio Communication Management	5	4	4	-
Portfolio Risk Management	4	4	-	-

In addition, based on the knowledge of the organization, its strategy, the characteristics of the environment, the probabilities of these risks are evaluated $p_{jk}, k = \overline{1, K}$.

The negative risk associated with non-fulfillment of the management process provided for in the generalized table is estimated by the value of the product of the probability and the consequences of the risk event.

For the considered approach to project portfolio management, a generalized process table is filled in. For cells of the table that do not contain management processes, the product of the probability of

the occurrence of a risk event by the consequence of such an event is determined. The resulting works are added.

If the cell of the table contains the management process, s_{jk} , $k = \overline{1, K}$ then, is taken equal to zero.

If some cell of the generalized table contains a management process, but experts believe that because of the imperfection of this process, anyway, the probability of occurrence of negative consequences remains, then the corresponding value can be assigned a non-zero value. In this case, the probability of such a risk event is also assessed.

As a result, we obtain a risk assessment when using the considered approach to project portfolio management. This assessment does not consider the relationship between the individual risk events. Therefore, it can be supplemented by an expert assessment of the synergistic effect from the entire set of risks characteristic of the approach under consideration. This estimate should also be obtained as the product of the probability of a synergistic effect by its consequences. As a result, the risk assessment when using the j -th approach will be

$$R_j = \sum_{k=1}^{K+1} p_{jk} s_{jk}.$$

Table 5

Consequences of risks arising from non-execution of the process. (continued)

Knowledge Areas	Process Groups				
	Monitoring and Control				Closing of Components
	Accounting and forecasting	Control	Analysis	Decision making	
Portfolio Strategic Management	3	3	3	3	3
Portfolio Communication Management	4	4	4	4	-
Portfolio Communication Management	4	4	4	4	-
Portfolio Risk Management	4	4	4	4	-

The second component for evaluating a portfolio management approach is the cost C_j of its application. At the same time, it is necessary to consider the costs of purchasing tools for its implementation, which include computer equipment, communications, and software. Consideration should be given to the cost of training personnel, the ongoing costs associated with the operation of the selected tools. An important component of the costs is the payment for the work of the personnel involved in the implementation of the processes of the chosen approach to project portfolio management.

After the risk and cost estimates for alternative approaches to project portfolio management are obtained, the two-criteria optimization problem of choosing the most appropriate approach is solved

$$j = \arg \min_j \{R_j, C_j\}_{j=1}^J.$$

This task can take into account the restrictions on the allowable costs C_{per} , for the time of mastering the approach in the organization T_{per} :

$$C_j \leq C_{per},$$

$$T_j \leq T_{per}.$$

In the problem of optimizing the choice of approach, other restrictions can be considered.

10. Conclusion

When implementing project portfolio management, organizations choose one of the existing approaches or create their own approach, which considers the peculiarities of the internal and external environment, the specifics of the projects and programs being executed. Solving these tasks requires a complete and well-structured information about existing standards and guidelines in the field of project portfolio management. Consideration should also be given to suggestions in the literature and expert opinions on the components of an effective approach. To select or form an approach to managing a portfolio of projects in the work, it is proposed to create a generalized body of knowledge on managing a portfolio of projects. The structure of such a body of knowledge has been developed. It includes sets of principles, processes, practices, life cycles, organizational structures, and roles in portfolio management.

The body of knowledge is filled with information on five common standards and guidelines for managing a portfolio of projects.

Principles [1] and [2], grouped into 7 areas, which made it possible to compare them.

A method for choosing an approach for managing a portfolio of projects is proposed. The method is based on assessing the risks inherent in this approach when managing an organization's project portfolio in specific conditions, and the cost of portfolio management. The method involves solving a two-criterion optimization problem, considering the constraints on the permissible costs and time of mastering the approach in the organization.

Subsequent papers will use this method to select the best approach for managing an organization's portfolio of projects.

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