The 11th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications
22-25 September, 2021, Cracow, Poland

Models and Methods of Project Administration in 4P-environment

Nataliia Yehorchenkova [1], Oleksii Yehorchenkov [2], Yevheniia Kataieva[3], Serhii Mitsenko[3], Oleksandr Mohylnyi[3] , Svitlana Odokienko[4], Nataliya Babina[4] , Olena Verenych[1]
[1] Kyiv National University of Construction and Architecture, Prospect Povitroflotsky 31, Kyiv, knuba@knuba.edu.ua, http://www.knuba.edu.ua/
[2] Taras Shevchenko National University of Kyiv, 64/13, Volodymyrska Street, Kyiv, office.chief@univ.net.ua, http://univ.kiev.ua/ua/
[3] Cherkasy State Technological University, Shevchenko blvd., 460, Cherkasy, https://chdtu.edu.ua/
[4] Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka Street, 2, Kyiv, https://knutd.edu.ua

***Abstract*—Today's period of business development is characterized by many crises, the way out of which requires an increase in the number of various projects in all sectors of the economy. One of the important parts of project and program portfolio management is project administration. When a project is complex when there are many participants and interactions, the project administrator or even his team aren't able to perform their functions well. So, in the paper authors present developed models and methods of project administration in the portfolios of a project-oriented enterprise that can increase the efficiency of functional units of the project-oriented enterprise by creating a relevant information environment for projects and enterprises. The subject for future research is developing a project administration tool.**

Keywords—project administration; project and program portfolio; project-oriented enterprise

I. INTRODUCTION

Today's period of business development is characterized by many crises, the way out of which requires an increase in the number of various projects in all sectors of the economy. Enterprises form projects and programs portfolios that require coordination in the implementation and use of resources, clear executive discipline, links with the company's development strategy, and comprehensive control.

Today no system provides effective management of enterprises and projects and programs portfolios as a whole. This leads to ineffective management decisions related to the unnecessary works or their uncoordinated implementation. Therefore it is necessary to find scientific methods of creation of holistic systems of management of the enterprises, project and program portfolio, separate programs, and projects. Solving this problem requires the development of theoretical foundations and methods of project and organization management.

One of the important parts of project and program portfolio management is project administration. The need for effective project administration in project and program portfolios is associated with a significant amount of interactions and tasks. When a project is complex, when there are many participants and interactions, is the project administrator or even his team able to perform their functions well? This is not possible without special software. But modern administrative tools are incomplete functionally and do not solve all needs. The need to solve urgent problems of project administration requires the creation of a new technology that combines methods and tools for managing and administrating projects in a project and program portfolio. Therefore, special attention should be paid to the functions of the administrator in the project and program portfolio. Such functions are focused on bringing to the performers information on the tasks that are necessary to obtain the deliverable of the task and ensuring and verifying the completion of tasks. In other words, the main role of the administrator's functions is to deliver or control the delivered information tasks and control the provision of feedback to them. The created administrative tools should be aimed at administrative influence on each participant in the project implementation process [1-2].

The paper considers models and methods of project administration in the portfolios of a project-oriented enterprise. They, in contrast to the existing ones, integrate into a single module function of predicting the timing of important events and change management. This allows creating a single administrative tool at the levels of projects, programs, portfolios, and project-oriented enterprises.

II. THE PRIMARY RESEARCH MATERIAL

Nowadays, papers on project administration are more practical and take the form of project administration guides rather than research. For example, in the work [3] the author describes how to implement project planning, tracking, and reporting to control a large, complex project when many of the project team's managers and participants have limited prior experience implementing formal project management. The Project Administration methodology,

which evolved as a byproduct of the Somers Project, is one step removed from hands-on project management. It provides a project administration service for the project managers, helping them to define their plans, coordinate their activities across many organizations, and motivates them to maintain their committed schedules. The techniques that became Project Administration as the Somers Project progressed will be described against the backdrop of this live example. It is hoped that readers will find this information useful for planning and controlling their projects.

The document "Construction Project Administration Manual" of the Florida Department of Transportation [4] contains instructions for administering Department of Transportation Construction contracts and describes requirements and procedures for Final Estimate preparation associated with those contracts. This Manual provides instructions to Department representatives for administering items mandated in Florida Statutes, rules, and/or contract specifications and for the successful completion of construction contracts including instructions to assist those charged with the responsibility of documenting final quantities and preparing final estimates. This Manual ensures consistency in carrying out Department of Transportation policies and helps ensure that all construction contracts are successfully administered on a fair and equal basis.

The Project Administration Manual of Kingdom of Cambodia: Second Greater Mekong Subregion Corridor

Towns Development Project [5] describes the essential administrative and management requirements to implement the project on time, within budget, and by Government and the Asian Development Bank (ADB) policies and procedures. The PAM includes references to all available templates and instructions either through linkages to relevant URLs or directly incorporated in the PAM.

Based on the conducted analysis, the authors concluded that currently no works are devoted to the creation of models and methods of project administration in the project and program portfolio of project-oriented enterprises.

III. The Main Results of the Research

The tasks of managing project and program portfolios intersect with the functional tasks of enterprise managing. Based on this, the task of creating a single functional environment for managing projects, programs, project and program portfolio, and project-oriented enterprise (4P-environment) comes to the fore. Such an environment would include tools involved in both project and operational activities of the enterprise and provide a systemic effect of solving a set of problems of project and program portfolio management as a single system of functions.

Functional 4P environment (hereinafter - 4P environment) – is an environment that contains the internal information and functional environment of the project-oriented enterprise and the external environment of customers, which determine the priority of project products.

– P-prioritization
– P-projects
– P-programs
– P-portfolio

Project administration in the 4P environment is implemented through time management, management of financial and human resources, maintenance of documents and deliverables of works, control of project tasks. For instance, approval or obtaining permits, maintenance of documents, execution of orders, and so on.

Creating models of project administration in the 4P-environment should increase the efficiency of functional units by creating a relevant information environment for projects and enterprises [6-8]. The concept of "important event" is very important for such models.

An *important event* is an occurrence of which determines the beginning of a group of critical works, and/or the need for significant resource costs for the project.

To fully reflect all the processes of project administration in the 4P environment, the paper proposes to consider the following models and methods: prediction of the timing of important events and change management.

1. Prediction of the timing of important events. The basis for predicting the timing of important events is statistical and expert information about the possibility of an event. Each source of such information is characterized by two parameters: the probability that the event will occur in a given time, and the amount of confidence in this source. It is assumed that the probability of how much you can trust the source of information will be known. Then, based on the source credibility and the probability indicated by the source, you can estimate the probability of occurrence of some important event in a given time:

$$\overline{p_i^j(t_k)} = p_i^j(t_k)\cdot\alpha_i + \left(1-p_i^j(t_k)\right)\cdot(1-\alpha_i), \qquad (1)$$

where $p_i^j(t_k)$ – specified by the source D_i probability of occurrence of the event Q_j in the period $t_k t_k$;

$\overline{p_i^j(t)}$ – assessment of the probability of occurrence of the event Q_j in the period $t_k t_k$, taking into account the source credibility D_i;

α_i – the source credibility D_i (probability that the source was not mistaken in previous estimates).

Credibility assessment is formed as the average probability of correct predictions on the guessed timing of the event

$$\alpha_i = \frac{\sum_{k=1}^{n} p_i\ (t_k)}{n}, \quad (2)$$

where $p_i\ (t_k$ – the probability that was determined by the source Di for the true period $t_k\, t_k$ occurrence of the event Qj;

N – the number of events that have already occurred.

For many sources, formula (2) will look like

$$\overline{p_i^*(t_k)} = \sum_j p_i^j(t_k) \cdot \frac{\alpha_i}{\sum_i \alpha_i} + \left(1 - p_i^j(t_k)\right) \cdot \left(1 - \frac{\alpha_i}{\sum_i \alpha_i}\right), \quad (3)$$

where $p_i^*(t_k)$ – common to all sources assessment of the probability of occurrence of the event Qj in the period $t_k t_k$.

Predicting the timing of important events includes the following steps:

1. Assessment of sources of information credibility on preliminary predicts of events:

2. Identifying options for possible timing of an important event for the project^

$$T = \{t_k\}, k = \overline{1, m_t},$$

where m_t – several intervals where the possible occurrence of an important event for the project.

3. Obtaining from sources of information the probabilities of an important event for the project $p_i^j(t_k)$ $p_i^j(t_k)$.

4. Calculation of estimates of probabilities of an event occurring in these or those time intervals.

5. Calculation of the expected time interval for an important event for the project:

$$\overline{t^i} = \sum_k t_k \cdot \overline{p_i^*(t_k) t^i} = \sum_k t_k \cdot \overline{p_i^*(t_k)},$$

where $\overline{t^i}$ – the expected time interval for the event Qj.

2. Change management. Change management from the standpoint of the administrative approach is a process consisting of the following elements:

– understanding by the management the need for change in a particular management situation;

– the ability of management to predict the positive or negative consequences of applying changes to a particular management situation;

– identification by the management the factors that are most important in this situation;

– choosing the optimal method that would ensure the most effective achievement of goals in these circumstances [9].

The main difficulty in change management in a 4P-environment is to consider the consequences of that change. For instance, a resource delay in one project may create a delay in the execution of another project due to a lack of the required resource. To avoid negative impacts on the project's progress in the 4P-environment, change management includes a verification phase. As a result, all possible risks from decisions on making or rejecting such a change are identified (fig.1).

The project will change:

1. A schedule (list of works, duration of works, connections between works, resources for works).
2. Budget (cost items, cost amounts).
3. Responsibility matrix.

The sources of change and their consequences are given in table.1.

TABLE 1. CONSEQUENCE OF CHANGES

Changes of	Consequence of changes		
	Schedule	Budget	Responsibility matrix
Project and estimate or design and technological documentation	+	+	-
Key performers	+	-	+
Replacement of resources	-	+	-
Schedule and/or budget as a result of the project	+	+	-
Project manager	-	-	+

Based on this information, the authors can suggest the following method of change management in projects.

1. Reflection of changes and their classification.
2. If the documentation has changed - bring these changes to the engineering center with the formulation of the task of processing changes and deadlines.
3. Consideration of changes in the project schedule and budget proposed by the engineering center at the investment committee.
4. If changes are accepted - adjustment of the schedule and the budget of the project, their approval and delivery to executors and responsible. Completion. If not - item 2.
5. If the schedule or budget of the project is not implemented, the transition to item 8.
6. If it is necessary to replace the material resources, go to item 2.
7. If replacement of labor resources is a necessary transition to item 8.

8. Initiation changes to the project manager to schedule and/or project budget. Determining the deadlines for submitting proposals to the project schedule and/or budget.

9. Consideration of changes in the project schedule and budget proposed by the project manager at the investment committee.

10. If changes are accepted - making changes to the project schedule and/or budget, their approval and communication to the executors and responsible. Completion. If not - return the task to make changes to the schedule and/or budget of the project. Go to item 5.

11. If it is necessary to replace the project manager - coordination of the schedule/budget/responsibility matrix/project concept/project team/responsibility matrix with the new project manager.

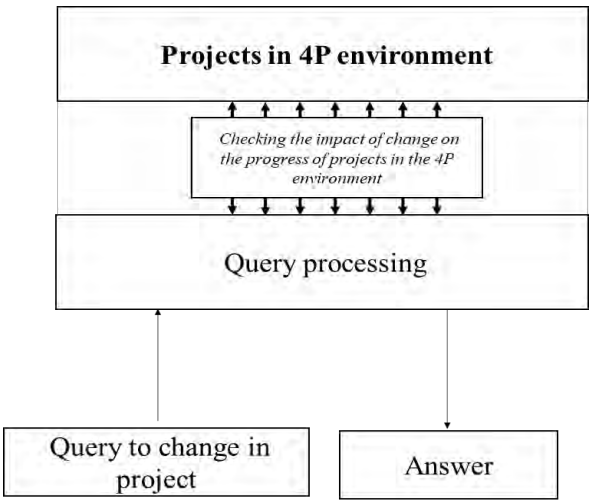

Figure 1. Formation of changes in the 4P environment

IV. CONCLUSIONS

The authors of the paper consider the models and methods of the processes of project and program portfolio administration in the 4P-environment, which include predicting the timing of important events and change management. Created models and methods increase the efficiency of functional units of the project-oriented enterprise by creating a relevant information environment for projects and enterprises.

The subject for future research is developing a project administration tool. Modern, most popular software tools such as Primavera and MS Project do not administer projects. The administrative tools implemented in them are functionally incomplete and do not solve all problems. There are no such procedures as predicting the timing of important events, change management, control of the performance of the task brought to the executor, or keeping open questions on each project. The need to solve urgent problems of project administration has led to the creation of qualitatively new technology for project-oriented enterprise management - a technology that combines methods and tools for project management and administration.

Such a system should automate project planning and administration information system to create an information environment for project management. It will provide solutions to the tasks of planning and administration of project decisions through time management, management of financial and human resources, record documents and results of work, monitoring the implementation of project tasks. It will be used, first of all, for the administration of actions on projects. It can also be used for project management in the traditional sense. It increases the efficiency of functional units by creating a matrix information environment for projects and enterprises.

It can be used in conjunction with MS Project by integrating functional application environments based on a single information base. Thus, MS Project is used for visualization of the system information environment, and also as the graphic editor at the construction of projects schedule [10].

Such a system will allow performing functions that do not perform traditional project management systems - the administration of all processes in projects.

REFERENCES

[1] M. Radujkovic, & M. Sjekavica, “Project management success factor,” *Procedia Engineering*, vol. 196, pp. 607-615, 2017. 10.1016/j.proeng.2017.08.048.

[2] A.L.R. Feger, G.A. Thomas, “A framework for exploring the relationship between project manager leadership style and project success,” *The International Journal of Management*, vol. 1, issue 1, pp. 1-19, 2021.

[3] E.P.Mahler, “Project administration methodology: achieving schedule control on a large project-the Somers Project,” *PM Network*, pp. 5, pp. 5, pp. 9–33, 1991.

[4] V. Jayasinghe, “Construction Project Administration Manual,” [Online]. Available at: https://www.academia.edu/35087276/CONSTRUCTION_PROJECT_ADMINISTRATION_MANUAL

[5] Project Administration Manual. [Online]. Available at: https://ewsdata.rightsindevelopment.org/files/documents/02/ADB-46443-002_NHLhwRz.pdf

[6] Project Management Institute. The view from above: the power of portfolio management. PMI White Paper. [Online]. Available at: http://www.pmi.org/~/media/PDF/Publications/PortfolioMgmt_whitepaper_FINAL.ashx

[7] O. Mulesa, “Design features of the information technology for the labor migrants group structure determination,” *Eastern-European Journal of Enterprise Technologies*, no. 2(76), pp. 4-8, 2015.

[8] V. Morozov, O. Mezentseva, M. Proskurin, “Application of game theory for decisions making on the development of it products,” *Advances in Intelligent Systems and Computing*, vol. 1246, pp. 377–394, 2021.

[9] T. Hunjak, “Planing and managing of project portfolio. Prezentation of TS HEP. [Online]. Available at: http://old.foi.hr/CMS_library/studiji/pds/mps/predmeti/materijali/Portfelj_projekata_TH.pdf (in Croatian)

[10] O. Yehorchenkov, N. Yehorchenkova, Y. Kataiva, I. Teslia, I. Mitsenko, “The Concept of an "Add-On" of a functional portfolio and project management environment,” *Proceedings of the XV International Scientific and Technical Conference “Computer Sciences and Information Technologies”*, Lviv, Ukraine, September 23–26, 2020.