Management of Critical Competencies in a Multi-Project Environment

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Abstract. The issues of managing critical competencies in a multi-project environment are considered. It is proposed to use the profile of critical competencies. A process approach to the management of critical competencies in a multi-project environment is proposed, the application of which will reduce the risks of critical knowledge losses.

Keywords: critical competencies; project management; multi-project environment; human resource management

1   Introduction

Projects are implemented in an aggressive environment, which is usually associated with the adverse impact of external factors (economic, political, actions of competitors, etc.). The instability of the project environment leads to the fact that the heads of organizations face the problem of losing the experienced staff involved in the project. The reason for the loss of human resources in the project is also a subjective factor (internal displacement, illness, retirement, relocation, death, etc.). For state-owned enterprises, the issue of aging is acute. As part of ensuring the implementation of the human resource management strategy in a multi-project organization, the formation of a project team should provide for continuity and management improvement based on the principles of knowledge management. Thus, despite the increased attention in recent years to human resources management processes in project management, the formation of effective teams with critical competencies for the project is relevant.

2   Literature Analysis

The transition from project management to program / portfolio management leads to the formation of additional requirements for the management of critical knowledge of the organization.

The formation of a multi-project environment is caused by the need to apply a unified methodology for managing large-scale (usually, territorially distributed) projects united by common resources. The limited availability of resources in the implementation of projects leads to the need for a rational approach to their distribution [1-4].

At the management of critical knowledge in the nuclear industry, the focus is on prevention of the loss of critical knowledge [5-7]. The issues of ensuring the successful implementation of the project, the reliability of the functioning of the team are considered in the basic standards and methodologies for project and program management (PMBok, Prince, P2M, etc.) [1-3].

Agile methodologies provide reliability and reduce the risks of losing critical knowledge through the use of parallel programming, effective communications, flexible response to emerging changes, focusing on teamwork. The danger of losing critical knowledge leads to the need to ensure the principles of redundancy in the formation of the project team.

Thus, the actual task is to develop effective methods for managing critical competencies in a multi-project environment.

3 Main Research Material

When managing human resources in a multi-project environment, project management must take into account that the project has critical knowledge.

Critical competences are defined by the job description and are particularly important for ensuring successful continuous operation of the organization. The presence of critical competencies is mandatory for persons appointed to a certain position [4].

When forming a project team, it is necessary to take into account the specifics of the project. As a result of the pre-project analysis, it is necessary to form a list of critical knowledge, on the basis of which a register of critical competencies is determined.

As the project team functions throughout the life cycle of the project, the requirements for competencies and critical knowledge can vary at different stages of the life cycle.

It should be noted that in the project activity, additional critical knowledge must be taken into account: experience in implementing similar projects; ability to organize team work; communication intelligence. Under critical project knowledge, it is proposed to consider the totality of knowledge, competences, methodologies, models and methods necessary for the successful implementation of the project under given constraints. Project knowledge is the total knowledge of people who participate in the planning and implementation of the project.

The level of criticality of knowledge in the project is determined by the specifics of the project, its uniqueness and importance for the organization, the availability of documented retrospective information.

In general, the critical competence of a multi-project is described by the following characteristics:

- threshold level of critical competence for the project - the minimum level of competence that is required for project team members (L_{min}^{P}) can be different in different projects of the multi-project
- the minimum number of project team members with this critical competence;
- the time interval at which this critical competence is required.

Depending on the specifics of the organization and requirements for competencies, a scale of measuring critical competencies is defined. For each critical competence, the project establishes the required level of competence L_p.

Formation of the register of critical competences of the multi-project will allow determining the directions of personnel development (Table 1).

Table 1. Registry of multi-project's critical competences

Critical competencies	Project P_1			Project P_2		
	L_{min}^{P1}	L_p^{P1}	L_f^{P1}	L_{min}^{P2}	L_p^{P2}	L_f^{P2}
Kcr$_1$	10	40	17	-	-	-
Kcr$_2$	20	60	35	15	30	30
Kcr$_3$	20	30	20	20	50	50
Kcr$_4$	20	20	50	-	-	-
Kcr$_5$	15	20	20	20	24	24
Kcr$_6$	20	30	30	20	25	30
Kcr$_7$	15	50	46	30	35	35
Kcr$_8$	30	20	30	20	20	25
Kcr$_9$	40	45	45	-	-	-
Kcr$_{10}$	-	-	-	10	20	20
Kcr$_{11}$	-	-	-	30	35	35
Kcr$_{12}$	-	-	-	15	20	20

As a result of the analysis of the critical competencies of the employees included in the company's pool of resources and candidates for the project team, the actual level of L_f critical competencies for team members in the project is determined.

Let the multi-project include projects P_1, P_2, …, P_n.

The multi-project team K_{mp} consists of projects' K_1, K_2 …, K_n teams and multi-project K_0 management team:

$$K_{mp} = \bigcup_{i=0}^{n} K_i \qquad (1)$$

For each project team, a critical competency profile Kcr is defined.

In general, the profile of the critical competencies of the multi-project team is the integration of the critical competence profiles of the project teams that are part of the multi-project and the critical competencies of the multi-project management team.

When implementing a multi-project, it is possible to redistribute the members of the teams with critical competencies that are not active at this hour interval to other projects.

Critical competencies for the multi-project, which can be ensured through redistribution of resources denoted as Kz.

Considering the set Kz the profile of the critical competences of the multi-project has the following form:

$$K_{cr\,mp} = \bigcup_{i=0}^{n} K_{cr\,i} - K_z.$$ (2)

To visualize the profile of the critical competencies of the project, a diagram (Fig. 1) can be used, where the axes are critical competencies, and the values - the level of competence criticality.
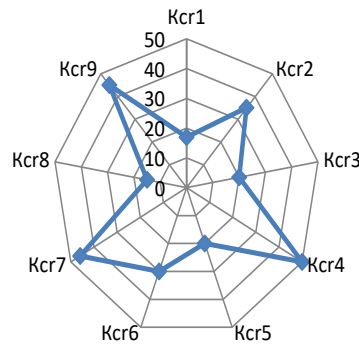

Fig. 1. Visualization of the profile of critical competencies of project P_1

Creation of the profile of the critical competencies of the multi-project / program / portfolio of the organization's projects allows you to determine the competencies most critical for the organization. Based on these data, a set of measures is being developed to ensure the development of critical competencies.

Increasing the reliability of the project team can be achieved by introducing principles: reserving competencies at the stage of the project team formation [8], the formation of adaptive project teams [9], taking into account the differentiation of access rights and the possibility of combining the work [10, 11].

Let $P_{Hr} = \{P_{Hr1}, ..., P_{Hr6}\}$ is set of processes of human resources management in the project [1]: P_{Hr1} – resource management planning; P_{Hr2} – evaluation of operation resources; P_{Hr3} – acquisition of resources; P_{Hr4} – development of team; P_{Hr5} – team management; P_{Hr6} – resources control.

It is proposed to consider the following processes for managing the critical competencies of the project team: definition of specific knowledge and skills for the implementation of projects (F_1); creation of a register of critical competencies (F_2); determination of the level of their criticality (F_3); analysis of the company's resource pool for availability in the required number of employees with critical competencies at a certain level (F_4); creation of a roster of candidates for the team (F_5); formation of the

project team taking into account critical competencies (F_6); monitoring of the register of critical knowledge (F_7); control over the change of the register of critical competencies in the course of the project implementation (F_8); development of a project team to maintain and develop critical knowledge (F_9); conducting post-project analysis (PPA-analysis) in the aspect of management of critical competencies (F_{10}).

In order to ensure knowledge management of the project team in a multi-project environment throughout the life cycle, it is proposed to use the projection of the processes of critical competencies management (CCM) on the human resource management processes of the projects (Table 2).

Table 2. Example of projecting the processes of management of critical competences for human resources management

CCM processes	Human resources management processes					
	P_{Hr1}	P_{Hr2}	P_{Hr3}	P_{Hr4}	P_{Hr5}	P_{Hr6}
F_1	+	+				
F_2	+	+				
F_3	+	+				
F_4	+	+	+			
F_5		+	+			
F_6			+	+		
F_7				+	+	+
F_8				+	+	+
F_9				+	+	+
F_{10}	+	+	+	+	+	+

Similarly, we form projections for each project that is part of the multi-project / program or project portfolio. In the proposed projection, you can indicate the degree of influence on the process, which will allow you to trace the relationship of processes.

After constructing a contextual model of management processes for critical competencies, it is expedient to perform their decomposition. For modeling of processes it is proposed to use the software product AllFusion Process Modeler.

Aware of the interrelationship of human resource management processes, the changes taking place in one of the processes that lead to changes in others. For example, if a control of resources(P_{Hr6}) was performed within the critical competencies control process (F_8)and showed that there are not enough specialists with critical competence in the project, the project manager should analyze the possibility of developing the necessary competence of the members of the existing project team(P_{Hr4}) or, if this is not possible, to purchase resources(P_{Hr3}).

In order to reduce the influence of the subjective factor in the formation of the project team, it is proposed to use specialized software [12, 13]. The developed software package allows to formulate project teams under the given restrictions (reservation of critical competencies, adaptive commands, prohibition on the combination of roles by project team members).

4   Conclusions

Applying the process approach to managing critical competencies in a multi-project environment will reduce the risks of losing critical knowledge in the organization, which is especially important in the current economic situation.

A promising direction of the research is the development of methods for the formation of project teams with the reservation of critical competencies.

References

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) 6th Edition, 2017, 756 p.
2. S. D. Bushuev, D. A. Bushuev, "Basics of Individual Competencies for Project Management, Programs and Portfolios (National Competence Baseline, NCB Version 4.0)" in *Project portfolios management,* vol. I, Kiev: Sammit-book, 2017, 168 p. (in Russian)
3. F. O. Yaroshenko, *Guidelines Projects and Organizational Programs Innovation Management*, Kiev: Noviy druk, 160 p. (in Ukrainian)
4. Novikov D. Control Methodology. – New York: Nova Science Publishers, 2013. – 76 p.
5. *Knowledge Management for Nuclear Industry Operating Organizations. International Atomic Energy Agency.* Available at: https://www-pub.iaea.org/books/IAEABooks/7515/Knowledge-Management-for-Nuclear-Industry-Operating-Organizations (accessed 25/02/18).
6. *Risk Management of Knowledge Loss in Nuclear Industry. International Atomic Energy Agency.* Available at: http://indico.ictp.it/event/a07171/session/21/contribution/13/material/0/0.pdf
7. M. Jennex, S. Zynger,"Security as a Contributor to KnowledgeManagement Success"in*Information Systems Frontiers: A Journal of Research and Innovation*, Vol. 9, No. 5, 2007, pp. 493-504.
8. N. V. Dotsenko, L. Yu. Sabadosh, I. V. Chumachenko, *Methods of human resources management in the formation of multiproject and program teams*. Kharkiv: Kharkiv national university of urban economy, 2015, 201 p. (in Ukrainian)
9. I. V. Chumachenko, N. V. Dotsenko, N. V. Kosenko, L. U. Sabadosh, "Formation of adaptive project team" in *Project management and Porduction development,* Vol. 2 (38), Lugansk, 2011, pp. 67–71. (in Russian)
10. N. V. Dotsenko, L. U. Sabadosh, I. V. Chumachenko, " Management competencies in the formation of the team multiproject" in *Eastern European Journal of Advanced Technologies,* vol. 1/10 (61), 2013, pp. 16 – 19. (inRussian)
11. N. Dotsenko, D. Chumachenko, I. Chumachenko, "Project-oriented management of adaptive teams' formation resources in multi-project environment" in *CEUR Workshops Proceedings*, vol. 2353, 2019, pp. 911-923.
12. N. V. Dotsenko, Computer program "Program for forming teams of projects in a multi-project environment", №60343, 30.06.2015
13. I. V. Chumachenko, N. V. Dotsenko, L. Yu. Sabadosh, *Computer program "Program of formation of adaptive teams",* №45422, 03.09.2012
14. N. Dotsenko, D. Chumachenko, I. Chumachenko "Modeling of the processes of stakeholder involvement in command management in a multi-project environment", 2018 IEEE 13th International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2018 – Proceedings, 2018, pp. 29-32.