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PROJECT MANAGEMENT IN CLASS ORGANIZATIONAL AND TECHNOLOGICAL SYSTEMS

ZARZĄDZANIE PROJEKTAMI W GRUPIE SYSTEMÓW ORGANIZACYJNYCH I TECHNOLOGICZNYCH

Abstract: The article deals with the analysis of the main issues of the project as the organizational and technical (technological) systems. Abstract concept of the project, the properties of the model and the concept of the project, the properties of the model of organizational and technical (technological) systems. The findings provide an opportunity to consider the

project in the class of organizational and technical (technological) systems that will be used in project management combined modern techniques and technologies.

Keywords: project, project management, organizational and technical (technology) system

Streszczenie: Artykuł zajmuje się analizą głównych zagadnień związanych z zarządzaniem projektami w systemach organizacyjnych i technicznych (technologicznych). Podjęto w nim takie zagadnienia, jak: abstrakcyjne koncepcje projektu, właściwości modelu i koncepcja projektu, właściwości modelu, systemów organizacyjnych i technicznych (technologicznych). Wyniki te są okazją do rozpatrzenia projektu w grupie systemów organizacyjnych i technicznych (technologicznych), które będą wykorzystywane w zarządzaniu projektami w połączeniu z nowoczesnymi technikami i technologiami.

Słowa kluczowe: projekt, zarządzanie projektem, system organizacyjny i techniczny (technologiczny)

Introduction

The increasing complexity of the project management necessitates the use of modern techniques, including intelligent. To be able to use these methods of managing complex objects occupies a special place class organizational and technical (technological) systems (OTS).

OTS – polysystem complex, which combines the properties of organizational and technical (technological) systems. OTS is characterized by the presence in the management of human, that is, the decision-maker. This is directly related to phenomena such as reduction of reliability, quality control in real time, an inability to recycle the large amount of information, the slow development of new control functions, and others. On the one hand, and the mobility, agility, tolerance to a change in structure on the other side¹.

In these circumstances, the prime requirement for Project Management is to provide flexibility, mobility, universalization in achieving high performance, speed and adequacy of decision-making and implementation of appropriate strategies in the external environment and the internal dynamics for the timely achievement of the planned strategic indicators.

1. Analysis of recent research and publications

The problem research project as an organizational and technical system discussed in scientific papers Burkov V.N.², Novikov D.A.³, Yuditsky S.A.⁴, Teslenko P.⁵ In [2] [3]

¹ T.O. Prokopenko, *Information models of control of the continuous type technological complexes in the class of organizational and technical systems*, „Journal of Automation and Information” 2014, 5, p. 64 -70.

² V.N. Burkov, A.U. Zalozhnev, D.A. Novikov, *Graph Theory in managing organizational systems*. M. SINTEG, 2001, 124.

³ D.A. Novikov, *Control theory of organizational systems*. M.: SAG 2005, 584.

⁴ S.A. Udickii, *Count dynamic simulation of network structures* Управленіе, bolshimi sistemami. 2008, Vol. 3, p. 45-62.

⁵ P.A. Teslenko, *Project as a managed organizational and technical system*, Visnik Natsionalnogo tehnicznego

and [4] examined mainly methods of project management as an organizational system. In [5] the main focus is on the research of technical and organizational nature of the project as part of organizational and technical system. However, these studies did not paid attention to the influence of external factors in conditions of uncertainty and risks.

2. Formation whole articles

The aim of this work is the study and analysis of the project as the organizational and technical system in conditions of uncertainty and risks.

3. Presentation of the main research

The main feature of organizational and technical systems is that it is – a system consisting of subsystems of various kinds and nature. OTS has a special internal structure and organization special and can contain any number of subsystems as organizational and technical.

For organizational and technical systems, taking into account the principles of system analysis⁶, characterized by the following properties:

- integrity, unity, which means that the relationships and interactions of system elements that give effect to the objective function of the system;
- the emergence, property systems, which causes the appearance of new properties and qualities, not peculiar to any elements that make up the system;
- the organization – a complicated feature of which is the presence of the structure and functioning (behavior);
- functionality – is a manifestation of certain properties (functions) in the interaction with the environment. Also defined target (destination system) as the desired end result;
- structuring – it's ordering system and a specific set of layout with links between them;
- the presence of behavior – action change, functioning, etc. It is believed that behavior associated with the environment, with other systems with which the system enters into certain relationships;
- the fundamental property of systems is stability, that is the system's ability to withstand external influences and disturbance. Depends upon the life expectancy of the system;
- reliability – preserving the structure of the property;
- adaptability – ability to change the behavior or structure to preserve, improve or acquire new skills in a changing environment. An obligatory condition for the possibility of adaptation is the presence of feedback.

universitetu „KhPI”. Collection of scientific works. – Kharkiv: NTU „KhPI”, 2010, 57, p. 198-202.

⁶ N.N. Moiseev, *Mathematical Methods of Systems Analysis*. Moscow: Nauka, 1981, 488.

Integrity and emergence – integrative properties of the system. Availability integrative properties is one of the most important features of the organizational and technical system. Integrity manifested in the fact that the system has its own pattern of functionality, its own purpose.

The most important characteristics of OTS, taking into account the seasonal factor is multidimensionality, the complexity and variability patterns, availability and change many purposes, indeterminacy, activity and others.

Any system characterized by the composition, structure and functions. Model organizational and technical system taking into account the seasonal factor can be set as follows:

- OTS composition (organizational and technical (technological) subsystem, which in turn are decomposed to the elements);
- OTS structure (a set of information, management, technological and other relations between the parties and elements OTS);
- set of admissible strategies (limits and standards activities) OTS participants, reflecting including institutional, technological and other restrictions and regulations of their joint activities;
- benefits participants and OTS elements;
- awareness – information on existing options held by members of OTS at the time of making decisions about strategy chosen;
- the functioning (sequences of obtaining information and selecting participants strategies OTS).

Defines the elements of composition and structure of their interaction, the permissible set - the possibility of elements landing features – striving items awareness – availability of information.

In terms of project management methodology⁷, the project is considered as a single set of actions and tasks and characterized by the following features:

1. Clear goals, to be achieved with simultaneous execution of a number of technical, economic and other requirements.
2. Internal and external relationships of operations, resources and tasks that require precise coordination in the implementation of the project.
3. Specific start and end dates of the project.
4. The limited resources.
5. A certain degree of uniqueness of the project objectives, terms of implementation.
6. The inevitability of various conflicts.

Project has the following properties:

- difficult hierarchical structure. Several different structures operating in the project. They are hierarchical. The interaction between them is not reduced to a simple hierarchical subordination relations;

⁷ T.O. Prokopenko, and A.P. Ladanuk, *Information technology management organizational and technological systems*. Cherkassi: Vertikal, vidavec Kandich S.G, 2015, p. 224.

- the impact of the project are in interaction of objective and subjective factors;
- dynamic processes are stochastic in nature;
- integrity (emergence) of the project is the presence of such properties that are not inherent elements of the system (subsystems), considered separately, outside the system;
 - complex information processes caused by numerous relationships between elements of the system;
 - the multiplicity of objectives that may not coincide with the goals of individual elements (subsystems) (known example – the high cost of maintaining managerial staff leading to the need to reduce it, but on the other hand, of small administrative apparatus does not ensure effective project management, leading to financial losses).

These properties allow us to consider the project as organizational and technological system. The project belongs to a class of organizational and technical systems. Based on the definition and properties of the model project is defined as follows:

- the project, that is, on the one hand we have the project participants, representing organizational component of the project, and elements of the technical system on the other hand;
 - structure of the project: the project has a structure of work, organizational structure, the structure of objectives;
 - set of acceptable strategies for the project defined project goals, timing performance, resource allocation in the project and others;
 - benefits are set by project participants reflected the relationship between the project participants and project participants' relationship with other elements of the project;
 - awareness regarding the project is characterized by the collection, processing and analysis. The main function of any system of governance – to provide information and determine on the basis of the development strategy of the system;
 - the functioning of the project characterized by the ability to subjugate a deliberate action, providing resistance operation, maintenance or acquisition of certain qualitative features, performance of a given action programs, etc.

Project management is the identification, establishment, management and development of links between elements of the project, to ensure the achievement of project objectives.

The functions of project management are: planning, monitoring, analysis, decision making, budgeting, organization of project implementation, monitoring, evaluation, reporting, examination, inspection and acceptance, accounting and managerial accounting, administration. Management is carried out at all stages of the project cycle.

Project management consists of the following subsystems, according to⁸:

- Scope Management;
- Cost Management;
- Quality Management;
- Procurement and Supply Management;
- Resource Management;
- HRM;
- Change Management;
- Risk Management;
- Inventory Management;
- Integration Management;
- Information and Communication Management.

Mandatory prerequisite for the successful implementation of the strategy is the initial phase of strategic management, in which is the formation, interpretation and clarification purposes, the construction of alternative scenarios strategy implementation and evaluation of ways to achieve their goals. Therefore, the authors identified the following strategic tasks of managing complex organizational and technological objects:

- 1) formation of the structure and objectives of project management, establishing causality on the set objectives;
- 2) assessment and analysis of the environment (definition of impacts, uncertainties, risks);
- 3) identify strengths and weaknesses of the project;
- 4) construction of alternative options to achieve goals;
- 5) development and analysis of scenarios motion of financial, material and information flows within the project and between the project and the environment.

Integral dynamic characteristic of the project is in a class of OTS configuration of the project. The configuration of the project consists of the following components:

- hierarchical structure of goals, which is aimed at achieving project;
- project processes with non-zero length of time under which resources are consumed different types (financial, information, material, personnel, etc.) And emerging values of the efficiency of the project;
- order processes in the project, expressed causal (causal) relation on the set of processes.

In implementation of the investment phase of the project, due to both external events and internal situations, the configuration of the project may change. In general, the linear sequence of configurations implemented project. Therefore, in the class of OTS performed construction and analysis of visual configurations formal models of project and development of methods of transformation (transformation)

⁸ *APM body of knowledge: Fifth edition*, UK.: Association for project management, 2006, 421.

of one configuration to another. Simulation configurations to determine the dynamics of the objectives consumption, changes in project performance under different external and internal conditions.

Modeling of configurations research project is the foundation of the investment phase, which enables:

- determine the most effective business strategy as a result of awareness of the upcoming changes in the business environment and the observed dynamics of the project;
- develop new opportunities for further business development;
- prepare for possible changes in the business environment to reduce the negative effects of unfavorable situations and reduce the risks of investment.

Therefore, it is appropriate modeling of the dynamics of transformation configurations OTS class project that will help build long-term strategy of the project, with the use of intellectual synthesis technology solutions and regular formal methods.

The speed and adequacy of decision-making in the management of projects and their implementation in terms of growth of complexity management processes must meet the strategies of external environment and internal speakers for timely achievement of the planned strategic indicators. The strategy in today's conditions is an important element in project management. Decisions taken under uncertainty, lack of clarity on the object data management and rapid change goals today may have a decisive influence in the future. External project management environment characterized by uncertainty and volatility properties. Instability is manifested in the fact that the rate of change of the environment grow, and uncertainty - that the emerging situation are increasingly becoming brand new. In the face of uncertainty in class project management organizational and technical systems will clearly define management methodology and provide the necessary information to make management decisions.

So important is the project management in a class of organizational and technical systems that will ensure through the integration of information resources, mining semi information to support the management of monitoring and analysis of results, timely warn management about emerging changes that can have serious consequences in the management of the project. Moreover, important to ensure that the person who makes decisions, according to the forecast analysis, characteristics of emerging or unexpected threat, and on the basis of the results generate possible countermeasures and their evaluation, ranking, with a view to making the most effective decisions and their implementation.

In the management of projects at dramatically increasing uncertainties subjective OTS in management decisions can play a crucial role. Because uncertainty is one of the important problems.

In project management under uncertainty must consider the following risks:

- increases sharply negative consequences of mistakes in choosing alternative solutions and their implementation. In the face of uncertainty possible directions

making a radical change and there are new opportunities, and those that existed previously, disappear because errors in the selection and implementation of the project can be fatal;

- do not work routine, the usual procedures and schemes;
- there is strong resistance to change, causing unforeseen delay, additional costs and uncertainty of the process of strategic change.

The uncertainty that arises in assessing the situation and choosing design solutions to an end, forcing the subjective OTS use in analyzing situations and the choices of design decisions based on his knowledge, experience and interests. Correct selection of the analyzed information is crucial in assessing the situation. So important are the demands of the environment and its impact on the internal state of the project, included in the class of organizational and technical systems.

Model project in class organizational and technical (technology) systems in conditions of uncertainty and risks is of the forms:

$$MSU = (C, S, RO, RI, P, F, Risk, K, U, E), (1)$$

where parameters into account: *C* – purposes; *S* – strategy, *RO* – external resources, *RI* – internal resources, *P* – projects, *F* – Processes, *Risk* – risks *K* – control, *U* – Management, *E* – effect.

Project management in a class of organizational and technical systems have a number of the following benefits:

1. The use of innovative methods and approaches, including intelligent methods to strategic management under uncertainty and risk;
2. The application of new methods of analysis, storage and various design-technological, organizational and management information corresponding to the complexity of internal and external environments;
3. The use of fundamentally new decision on forming the image information optimal strategic decisions;
4. The application of innovative models of functioning and rational distribution of investment flows in the implementation of strategic decisions;
5. The use of new information technologies, including intelligent that allow solving problems of identification, prediction, optimization and control of complex objects.

Thus, the project properties and model project give reason to consider the project as organizational and technical system. This gives the possibility of using modern management techniques, including intelligent, most importantly in terms of dynamic impact factors in conditions of uncertainty and risks.

Conclusions

The special factors that are taken into account for the selected class of OTS include: nature of the action elements of the project and the environment; Decision-

difficult tasks formalized project management, account external factors influence the environment, including seasonality, keeping the objectives and functioning of the project environment.

Project management in the classroom OTS enables the submission process management with the necessary degree of detail that will consider a number of additional (quality) characteristics in conditions of uncertainty and risks, and to form rational decisions. In addition, this approach enables project management in an uncertain environment reflect fully take decisions that change the environment, assess the results of operations and use various options to achieve the project goals.

The concept of the project, project properties, and project model allows us to consider the project in class organizational and technical (technological) systems, which today is a new type of system. Project management in the classroom will enable OTS to apply modern management techniques combined, combining regular formal methods of managing technical systems and heuristic methods that are specific to organizational systems. This will increase the efficiency of project management in terms of resource constraints, budget and time taking in conditions of uncertainty and risks.

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