An innovative model for managing the effectiveness of investment projects in construction

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Abstract. The article discusses the current issues of managing the effectiveness of investment projects in construction based on the innovative approach. An innovative model for managing investment construction projects based on the organizational and economic approach is proposed.

Introduction

The problem of investing in the construction industry is relevant in modern economic conditions. Construction is a part of the economy real sector, which indicates the importance of developing capital construction in the country. Due to the fact that the country's economy is not going through the best of times and there is an outflow of foreign investment, Russian companies have to improve methods for assessing the effectiveness of investment construction projects (ICP), which is also becoming most important in cities with a population of over one million.

The market economy is characterized by a high level of competition for production and sales markets; in this regard, the activities of most economic entities are carried out in conditions of uncertainty. This fully applies to construction organizations involved in the implementation of investment and construction projects. The uncertainty characteristic of the activities of the construction organization is associated with changing factors of the external and internal environment and manifests itself in the form of various risks that reduce the effectiveness of investment and construction projects and can lead to the disruption of contractual obligations specified in the general contract with the customer. [1]

There is a change in benchmarks, associated with an increase in the requirements for the equipment used, the technologies used and economic offers in the construction industry. The scale and complexity of ongoing investment and construction projects are increasing, which requires special attention to the organization of management, the timing of construction work and the quality of construction products. Despite the fact that existing methods of managing the investment and construction process are
constantly being improved, their use in practice does not always lead to an increase in the efficiency of ongoing investment projects and, accordingly, the activities of construction organizations.

Construction as an activity is material production and therefore has a significant impact on the development of a number of related industries and requires a fairly high investment volume. With the investment and construction projects implementation, the development of significant volumes of investment resources takes place, in connection with which the accuracy of evaluating their effectiveness is of particular importance.

Different stages of the investment construction project implementation require various financial investments, which are determined by the cost management processes. Based on the system, the input-output is determined by the dynamics of cost parameters, both in each phase of construction production and between the phases of the project for all its participants [2].

Time (along with quality, costs, flexibility) is an extremely important target for many enterprises. Market success is often brought to them by a reduction in the production cycle, exact adherence to delivery schedules, quick adaptation to changing conditions, and acceleration of new product development.

In the generalization form, the following five principles, on which the concept of competition is based on minimizing time as a management factor can be distinguished:

• time orientation - time is the subject to the quantitative assessment in the preparation and conduct of business operations;

• focus on a quantitative approach - if a company decides to double the speed of its operations, it has every chance of winning in the competition; minor improvements are insufficient;

• focus on the process - thinking on the scale of the entire production process facilitates optimization, allows to identify the bottlenecks;

• focus on value - elimination or expansion of bottlenecks, liquidation of activities that do not create added value;

• focus on working groups - the solution to the problem of bottlenecks is assigned to working groups.

Time-oriented management as the main factor of competition includes a number of important elements. First of all, the company should single out a set of processes understood as a certain type of activity with one or more cost factors, ensuring the release of a particular type of product or service.

The need for time for solving problems in the field of management can be reduced in many cases as a result of optimal communication between participants in the process. From the organizational point of view, this can be achieved with the greatest effect by the formation of working groups. These groups should be small in composition, with a clear delineation of functions for the common purpose of its members, which should maintain close ties with each other and with other groups. Such groups are characterized by a spirit of collectivism and high cohesion.

The goals and advantages of this labor form are self-organization, group discussion of problems, improving the quality of processes and labor productivity, multifunctionality, mutual support and understanding, flexibility, optimal communication, and the ability to resolve conflicts.

An important element of management based on the time factor is measuring systems, which should quantify the time aspects of all the main processes, including the time used for individual cycles, adaptation, development of new products and technologies, etc.

Recently, a growing number of markets arose, the development of which is closely linked to the time factor. This broadens the prospect of using the proposed competition practices [4].

It should be recognized that the problem of improving the investment and construction projects efficiency is relevant. On the one hand, this is due to the scale of construction and the volume of investment, and on the other hand, it is due to the insufficient development of the main economic, organizational, and managerial issues present at all stages of the project [5]. Despite the existing developments, many issues of improving the efficiency of the investment and construction process related to cost management remain unexplored.

To solve these problems, an author's scientific concept is proposed in the form of an innovative (organizational and economic) approach as a set of systemic measures, programs and algorithms of
multiplicative economic actions for optimizing production resources based on three ICP control loops: preliminary, main and final.

Which are:

I. The first ICP control loop is the UP-I loop: “Management at the project selection stage” includes the implementation of the following sequence of procedures:
   • analysis of the enterprise investment program, the structure of the implementation of investment and construction projects and the stages of their implementation;
   • selection of investment and construction projects for organizational and economic management of the ICP effectiveness:
     • analysis of projects, stages of implementation in PIC and PPR projects with the calculation of the reference indicators of management effectiveness.
   As the objects of study for the implementation of the control unit UP-I, the construction enterprises of the Volgograd city were investigated.

II. The second control loop is UP-II: “Management of the ICP effectiveness in the preparatory procedures for the EIA includes the implementation of the following sequential procedures:
   • development of a calendar plan in Project Management programs (for example, MS Project);
   • setting resource limits;
   • Planning a multi-factor optimal experiment;
   • regression coefficients’ calculation;
   • identification of the problematic field of ICP efficiency management.

III. The third control loop - UP-III: ”Management of the acceptable level of efficiency” includes the implementation of the following sequence of procedures:
   • the implementation of economic-statistical modeling procedures as a part of scheduling with a view to optimization;
   • development of an effective schedule for the implementation of construction and installation work;
   • monitoring the ICP effectiveness based on accepted optimization models;
   • determination of performance indicators of ICP after optimization.

This third circuit is the final stage of the innovation cycle of the organizational and economic approach to managing the effectiveness of investment and construction projects, which will improve the main economic indicators of the investment and construction projects and programs implementation [6].

To optimize the production resources and obtain a multiplier effect, an organizational and economic approach to managing an investment and construction project based on three contours is proposed: preliminary, main and final (Figure 1).
1. Analysis of the implementation of investment and construction projects initial situation in the organization

1.1 Analysis of the enterprise investment program, the structure of the implementation of investment and construction projects and the stages of their implementation

1.2. Selection of investment and construction projects for organizational and economic performance management: analysis of projects at the stage of PIC and PPR, with the calculation of ICP performance indicators

Control loop UP-I

2. Implementation of preparatory procedures for the organizational and economic approach to optimize the duration and cost using such software as Microsoft Project

2.1. Develop a calendar plan in the MS Project program and set resource limits

2.2. Planning a multivariate optimal experiment and calculating regression coefficients

2.3. Identification of the problematic field of managing the effectiveness of investment and construction projects.

Control loop UP-II

3. Implementation of the main procedures of the organizational and economic approach to optimize the investment and construction projects.

3.1. Performing procedures of economic and mathematical statistical modeling as part of scheduling for optimization purposes.

3.2. Approval of the final version of organizational and economic optimization of construction and installation work.

4. Development of an effective implementation schedule for construction and installation work.

4.1. Organizational and economic modeling of construction and installation schedule with optimal parameters.

4.2. Coordination and approval of an effective construction and assembly schedule taking into account organizational and technical aspects of implementation.

5. Performance management of investment and construction projects based on accepted optimization models.

5.1. Determination of performance indicators of investment and construction projects after optimization

5.2. Determination of the comparative economic efficiency of the proposed recommendations.

Control loop UP-III

6. Implementation of the organizational and economic approach proposal

7. The innovation cycle of the organizational and economic approach to regulating the ICP production resources in the system of internal planning.
**Figure 1.** Innovative performance management model investment projects in construction

The preliminary control loop assumes: analysis of the investment program of the organization and the structure of the ICP implementation; selection of an investment project based on the PIC and PPR analysis, performance indicators’ calculation.

Within the framework of the main control loop, the duration and cost of construction are optimized using software products: a schedule is developed in the MS Project program; resource limits are set; a multivariate experiment is planned with the calculation of regression coefficients; the desired values of the investment project performance indicators after the optimization procedure are determined [7].

The final control loop involves the organizational and economic optimization of construction and installation works as a part of scheduling; modeling of construction and installation schedule with optimal parameters; calculation of the performance indicators of investment and construction projects after optimization and the comparative economic efficiency of the proposed recommendations (Table1.).

The proposed approach to optimizing resource allocation in the calendar plans of work projects is reduced to the following sequence of procedures:

1. KP development in a program such as MicrosoftProject.
2. Establishing resource type constraints $RA_{i,min} \leq RA_{i,max}$.
3. Planning a multivariate optimal experiment.
4. Calculation of regression coefficients and their sorting by absolute value and sign.
5. KP optimization by increasing the number of active resources having negative regression coefficients.
6. Determination of the optimal construction time (resources) cost based on the obtained dependencies.

**Table 1.** The results effectiveness of the management of investment and construction projects based on the innovative approach

| №  | ICP Key Management Indicators | Management Initial Situation ICP | Management ICP | The effect of ICP innovative management approach |
|----|-----------------------------|----------------------------------|---------------|-----------------------------------------------|
| 1  | Net present value, rub.      | 11148600                         | 94328300      | +83126000                                     |
| 2  | Payback period, years        | 0,93                             | 0,79          | -0,14                                         |
| 3  | Discount payback period, years | 1                                | 0,8           | -0,2                                          |
| 4  | Internal rate of return (profitability) on invested capital, in percent | 20,74                           | 29,85         | +9,11                                         |
| 5  | Internal rate of return (profitability) calculated per planning interval, in percent | 5,08                           | 9,89          | +4,81                                         |
Thus, the result and effectiveness of managing investment construction projects is directly dependent on the size of the economic effect (income, profit), the payback period of the project and the duration of the investment cycle [8]. Comprehensive optimization of these indicators should be carried out by investors and project customers when developing the investment justifications and the business plans based on well-known regulatory and methodological documents. As a result of such calculations, the maximum and minimum possible (boundary) values of the estimated cost of building objects (depending on the options for economic efficiency of the project) should be determined, within which the investors and customers set the most acceptable contract prices with the contracting enterprises.

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