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Actual aspects of modeling method application in organization of construction management

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Abstract. The possibility of using the modeling method in the organization of construction management is analyzed in the article. It reveals the specifics of the methodology for forecasting and strategic planning in the investment and construction complex, as well as the principles and methods for implementing a universal expert method applicable to any research tasks. Particular attention is paid to the methodology of engineering forecasting as an analytical tool suitable for use in multi-factor models. The methodological foundations of managing the competitiveness of investment and construction complex subjects and methods for its assessment are studied. The importance of competitive factors and the need to take them into account when developing options of model constructions are also emphasized.

1. Introduction

The current stage in the development of investment and construction complexes (ICC) that have taken shape in the Russian regions is characterized by a number of distinctive features. The main ones include the unabated dynamism of market processes; the complexity of the internal structure; the intensity of competitive interactions, causing the modification of market proportions and initiating the emergence of new, additional risks in activities of construction enterprises [1-3]. The objectivity of these signs determines the need to increase the level of feasibility of management decisions implemented at enterprises of this type and, above all, strategic decisions that can take into account and reliably evaluate the entire set of external and internal factors in periods of different duration and adapt to them, while maintaining and maintaining the mode of effective functioning.

In searching for ways to solve this problem, one should pay attention to the possibilities of the modeling method which is identified by the theory and management methodology as a way of knowing complex systems, among which, according to the overwhelming majority of domestic and foreign researchers, is the investment and construction complex [4-6]. Construction companies as the main subjects of the ICS are actively involved in its processes and are its system-forming elements, endowed with internal system features.



The basis of the simulation is the procedure when between the researcher and the object of interest he becomes some intermediate link - a model. This link acts as a representative of the object, and the model mediation itself is based on some similarity of the model and the object to which the interests of the subject are directed. The model is characterized by the presence of clear rules for the transition from model information to information about the object itself and the generality of the property with the object being modeled. The model does not cover all the properties of the original, but only those that are important for the purposes of the study [7].

The aim of the study is the statement of reasons for applying the system modeling method in the management of investment and construction activities as a way of predicting future processes and phenomena allowing to determine measures of effective impact on the simulated object.

2. Materials and Methods

In the practice of managing investment and construction activities, specific subject-oriented models are used which in essence can be characterized as investment programs. The subject of management in the case of their application is empowered with respect to the formation and adoption of investment decisions.

In regional investment and construction complexes, such entities can include construction companies whose activities always synthesize production and investment components, and organizations of investors interested in the development of highly profitable construction activities [8,9]. There are four types of problem-oriented models:

- forecasting model;
- strategic model;
- tactical (technical and economical) planning model;
- operational (operational and production) planning model.

From the standpoint of strategic management of investment and construction activities, the first two of them deserve the most attention because they lay the foundation for the reasonable market behavior of ICC subjects, their ability to long-term functioning in the complex environment of the investment and construction market with its variability and dynamism.

The forecasting model in the strategic management of investment and construction activity is a document (forecast) which reflects the development trends of ICC, its external and internal environment for the foreseeable future. Like any forecast, it has high uncertainty and should be developed in several options with an assessment of their probability and in accordance with the forecasting methodology [10].

The methodology of forecasting formed in the national scientific school and based on a stable theoretical platform contains a number of mathematical methods recommended for use in the forecasting process: least square method, thresholds, exponential smoothing. Their effectiveness is not in doubt but the possibilities for practical application are limited by (as a rule) the level of information support of the procedures provided for by this or that method of forecasting.

Such limitations drastically reduce the practical value of these methods (with all their theoretical validity) and impose additional requirements on the ICC management system - to achieve the highest possible completeness and accuracy in the multi-factor information necessary to form reliable predictive estimates regarding the prospects for the development of investment and construction activities and its subjects [11].

3. Results and Discussion

The difficulties of applying a number of well-known forecasting methods determine the need and expediency of focusing on the method of expert assessments, the indisputable advantage of which is universality and applicability to any research tasks.

The effectiveness of the method of expert assessments is often doubtful. It is considered not to be good because of proximity, inaccuracy, subjectivism, due to the dependence of the results obtained on the qualities inherent to experts, their level of competence and experience in solving specific tasks,

completeness of possession of source information, interest in obtaining objective assessments, as well as their degree of independence and personal qualities [12].

In a certain sense, these reproaches are valid – the accuracy of the expert method is inferior to the accuracy of mathematical methods, but within the framework of prediction, the approximation of estimates is quite acceptable. It is possible to improve the accuracy of the forecast and to ensure the required accuracy of the results by meeting the requirements of the algorithm for prediction procedures. They include:

- clear formulation of the problem to be solved using the expert method;
- unambiguity of the questions posed and the possibility of obtaining unambiguous answers;
- meeting the judgment independence principle;
- respect for the principle of independence of judgment;
- attracting a sufficient number of experts.

The last requirement needs clarification. In practice, it is not uncommon when several, or even one expert is attracted to solve a particular problem, to determine the prospects for its development, to analyze the specific situation in the ICC, to identify the reasons that gave rise to this situation [13]. Of course, they are selected from among the most famous experts in the field of ICC management, specialists whose competence has been repeatedly confirmed and supported by the business community that has developed in the investment and construction complex. But limiting the number of experts, regardless of all other factors, entails a manifold increase in the error in obtaining the final results. In this regard, it becomes extremely important to determine the necessary and sufficient number of experts involved in forecasting the development of the ICC [14]. In search of practical recommendations on this issue, it is advisable to refer to such a direction of strategic management methodology as engineering forecasting.

Engineering forecasting focuses on obtaining weighted average estimates in multifactor models that are not comparable in formal characteristics. Such estimates cannot be obtained without application of the expert method, the ideology of engineering forecasting, its principles and methodological content are aimed at ensuring the correct application of this method, its algorithmization and interpretation of the results obtained.

The statement about the need to attract 25-30 experts to conduct expert procedures is critical [15]. Such a size of the expert group does not seem too high. Moreover, it “opposes” the tendency to maximize the number of experts reflected in a number of methodological developments. For example, when forecasting the demand for construction products, they often seek to conduct large-scale studies, covering hundreds and thousands of people – consumers, other ICC participants, investment management specialists, who are experts in this case [16, 17]. Such studies are sometimes useful but they are not necessary for solving forecasting problems. Significantly greater effect (with significantly lower costs) can be obtained through the use of the engineering forecasting method, subject to compliance with all its requirements.

Prediction is carried out element-by-element throughout the structure of the ICC and taking into account the links between the elements of the external and internal environment and between environments.

The immanent uncertainty of the environment causes the uncertainty of the forecast [18]. It is impossible to eliminate this uncertainty but it is possible to ensure its reduction by developing several options of the forecast and estimating the degree of probability for each of them.

Theoretically, the number of options can be infinite but for managerial practices limited by certain frameworks (by time, by the laboriousness of the management decision-making process, by management costs as a whole and by decision-making), the presentation of the ICC development forecasts in three options can be considered sufficient. One of them should be considered as the main and most likely. The other two, which, as a rule, are called optimistic and pessimistic, or elevated and reserve, are formed on the basis of possible changes in the dynamics of the predicted factors (taking into account the probability).

The formation of such options as a basic element of the development of the forecast is carried out by bringing together the results of element-by-element forecasting. This task is one of the tasks of increased complexity, its successful solution can be described in categories characteristic of scientific creativity, when a researcher, armed with an arsenal of system and specialized knowledge, uses various methods: formalized and non-formalized, accurate and conventional, but always adapted to the task and fully consistent with the scientific logic. Combining methods and adapting to the structure of the array of information used in a particular case, evaluating the completeness, reliability, accuracy of information, the researcher, based on his own intellectual efforts, forms uniform forecast models [19].

Despite the fact that the forecasting model takes into account both external and internal factors (like any socio-economic model), factors related to the category of external play a dominant role in its development. A special place among them is occupied by competitive factors which, along with trends in the development of the STP in construction, in cases of their correct recognition and the adoption of appropriate adaptation measures can be key success factors for any of the ICC subjects, and vice versa - in case of their disregard or incorrect assessments - they can essentially destroy activity displacing the ICC subject from the constantly transforming competitive "field" [20].

The importance of competitive factors should be considered not only when developing a forecasting model, but also in a strategic planning model, the next stage in the hierarchy of model constructions. Strategic planning in the ICC, with its high investment capacity, is realized through the development of investment projects - documents in which long-term planning tasks are supplied with large-scale investment rationales [21].

Both the forecasting model and the strategic planning model (in the form of an investment project) fully correspond to the specifics of the problem-oriented models that are distinguished by the presence of a goal. To characterize the goal (the model of the expected result), it is advisable to use an indicator that has an integrative nature, i.e. combining a certain number of significant private indicators.

Management theory proposes the use of a number of summary indicators, methods and approaches to their formation. With regard to the problem under consideration - the development of a system of problem-oriented development models of the investment and construction complex, the indicator of competitiveness of ICC subjects can be used as such an indicator.

The method of its formation and practical application is determined by the methodological principles of competitiveness as an economic category [22]. The first of these principles is the principle of relativity. Its use means that competitiveness is always considered as a relative value determined during the comparison of several options among themselves. This principle is fully maintained when forecasting the development of the ICC and investment design which is always being developed on a option basis. The second of the methodological principles of competitiveness is the principle of integrity. In its application, private indicators of competitiveness are first determined, which characterize a particular factor that forms the competitiveness of the ICC subject and the products produced by it. The third methodological principle of competitiveness is the principle of using weighted average ratings. Its appearance is determined by the multifactorial competitiveness of the ICC subject and the varying significance of the determining factors. This principle can be successfully implemented through the use of engineering forecasting method.

Structural study of factors of competitiveness and the results obtained on its basis can form the basis for developing models of management decisions - active and implemented in a passive mode, adaptive and transformative, corresponding to the tasks solved by the ICC management system in specific conditions and specific time periods [23].

4. Conclusions

Summarizing the above, it is necessary to emphasize that the use of the method of system modeling in the organization of management of investment and construction activities provides the ability to solve complex management problems. Modeling as a method of practical or theoretical indirect operation of an object allows for an integrated consideration of the macro and microeconomic aspects of the interrelation of interests of all business entities of the ICS, and also helps to create conditions for using

a resource saving strategy, which is especially important in the conditions of technological progress, increased competition modern enterprises.

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