Application of the engineering forecasting method in managing the competitiveness of a construction company

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Abstract. The article discusses one of the pressing problems of managing a construction organization as a subject of the investment and construction market, focused on introducing new technologies and materials - the need to improve methods for assessing its competitiveness and making management decisions to ensure, maintain and develop the competitiveness in strategic and tactical periods. An algorithm for assessing the competitiveness of a construction organization based on the integration of particular indicators characterizing competitiveness, taking into account the significance and intensity of their determining effect is presented. The algorithm is formed on the basis of an engineering forecasting methodology intended for solving comparison and multi-criteria tasks. The necessity and possibility of using an expert method in assessing the competitiveness of a construction organization, requirements for the procedure for its application, as well as a methodical approach to the implementation of monitoring of the competitive environment of the investment and construction market are revealed.

Introduction

One of the tasks solved in the framework of the strategic management of a construction organization operating within the regional investment and construction complex is the need to ensure its competitiveness in strategic and tactical periods. When solving this task, one should be guided by the methodological principles of competitiveness management, which are formed taking into account the specifics of competitiveness as an economic category [1-5].

The most important of these is the principle of relativity of competitiveness, which means that it can only be assessed by comparing a number of options among themselves and cannot have an absolute value.

Orientation to the principle of relativity expands the research horizons, allowing to get not only the main result of the assessment procedures, to determine which of the construction organizations is more or less competitive, but also to identify the most acute problems constraining the growth of...
competitiveness in a particular situation in the investment and construction market, and also assess the factors stimulating its development in the current period and in the foreseeable future [6-8].

According to the results of an in-depth study of the mechanism of influence of determining conditions, management decisions can be developed, the implementation of which will make it possible to intensify and effectively use stimulating factors, neutralize (if possible) constraining factors, ensure a rational combination of incentive and deterrent measures, that is, form a balanced set of management actions that are adequate to competitiveness management targets.

**Materials and Methods**

The purpose of the study conducted in the work is to develop recommendations for improving the methods for assessing the competitiveness of a construction organization and forming management decisions based on the application of engineering forecasting methodology.

The theory and practice of modern management of construction organizations contains a number of methodical approaches to the assessment of competitiveness.

Most of them are generally focused on the relative competitiveness [9-13], but use methodical tools that, firstly, adhere exclusively to integrated assessments and do not have sufficient accuracy, and secondly, do not allow to obtain a number of additional effects - meaningful analytical results that can form the basis for the formation of management decisions that transform the building organization.

The most complete assessment of the competitiveness of a construction organization can be obtained through the use of an engineering forecasting method that has proven itself as one of the reliable ways to solve multi-criteria tasks, comparison tasks [14-16].

**Results and Discussion**

The engineering forecasting method is implemented as a sequence of several stages. At the first stage, comparable options are formed, which are several construction organizations. At this stage, it is extremely important to ensure the comparability of options, focusing on their scale, nature of activities, positions in the regional investment and construction complex, and the share of the investment and construction market, etc.

The second stage of the algorithm for assessing the competitiveness of a construction organization using an engineering forecasting method is to develop a list of factors that affect competitiveness, as well as measurable indicators and parameters reflecting the dynamics of these factors - particular competitiveness indicators. It is advisable to involve a group of experts in the formation of a list of particular competitiveness indicators, selecting experts from among specialists with knowledge and experience in the management of investment and construction activities [17].

The third stage of the algorithm under consideration is the ranking of indicators and parameters by degree of importance. The ranking should be carried out using the expert method, for example, with the involvement of an already formed group of experts. But if at the previous stage, the experts were given a creative task that requires an informal approach, then at this stage it is necessary to strictly follow the formal procedures inherent to the method of expert assessments with its clearly defined requirements.

The next, fourth stage of assessing the competitiveness of a construction organization consists in the selection of particular indicators or parameters as the main ones intended to be included in the procedure for determining the integral (composite) competitiveness indicator for each of the compared options. The basis of this choice is the hypothesis of a rapid decrease in the degree of influence of particular competitiveness indicators (in a sequence ranked by degree of significance) on the aggregate indicator.

At the fifth stage of the algorithm, the assessment of particular competitiveness indicators in physical units of measurement is performed, and the particular parameters of competitiveness (which reflect its quality characteristics) are assessed in points. The scale of scoring can be any, but in its
application (in general and when using quality parameters in the assessment), it should be borne in mind that the main advantage (property) of the engineering forecasting method is the correct integration of indicators with different dimensions, and point scores should be minimized.

It is this property of the engineering forecasting method that manifests itself at the sixth stage of the algorithm. Within its framework, the following methodical technique is applied: one of the compared options (determined at the first stage) is considered as a "reference variant", and the corresponding particular indicators are equal to one; particular indicators for the other options are expressed as a ratio to the unit, and take the form of particular competitiveness indexes. Such indexes do not have dimensions, which makes it possible to apply various methodical tools to them [18].

The seventh stage is associated with the search for integral indexes of competitiveness for each of the compared options (for each of the compared construction organizations). The integral index in the methodology of engineering forecasting is proposed to be calculated using the following formula:

$$ Y_u = \frac{\sum \phi_i Y_i}{\sum \phi_i} $$

Here $Y_u$ – the integral competitiveness index; $Y_i$ – the particular competitiveness index on the $i$-th indicator; $\phi_i$ – coefficient weight, reflecting the position of the $i$-th indicator in the sequence, ranked by degree of significance.

When determining the weight coefficient, the following formula should be used:

$$ \phi_i = \frac{i}{2i-1} $$

where $i$ is the place (position) of the indicator in a sequence ranked by degree of significance.

The method of determining the weight coefficient of particular indicators (indexes) of competitiveness expressed by the formula (2) has an important feature. It is not difficult to notice that for the indicators placed on the first and second place, it is equal to one. This means that if there are only two indicators in the ranked sequence, then their effect on the integral index of competitiveness is identical. But if a ranked sequence contains a larger number of indicators, the degree of their influence decreases as they move from more significant to less significant ones, and the nature of such decrease is uneven, due to the regularity described by the formulas (1), (2) and characterized the engineering forecasting methodology. The result of this stage is the determination of the integral indexes competitiveness for each of the compared options. For the reference variant, it is equal to one, for the other options it is expressed as a ratio to the unit.

The eighth stage consists in direct comparing the composite integral indexes of competitiveness with each other, it allows to clearly define more or less competitive options, which is the main result of the analytical process.

The main result is supplemented by the ninth stage, which can be identified as diagnostic one. Within its framework, a system of diagnostic procedures relating to the categories of qualitative analysis can be effectively implemented, and strategically significant conclusions are formulated.

First, the study of the structural characteristics of the composite index of competitiveness allows to clearly identify the factors that have the most active influence on it, and explore the mechanism of this influence. In particular, external or internal factors that determine the deviation of the integral index from the "reference variant" are determined [19]. Secondly, according to the results of a structural study of competitiveness factors, directions can be determined on which the strategy of the construction organization’s operation in a competitive environment should be oriented [20]. The strategic guidelines, determined by logical choice, should subsequently be transformed into specific goals of the development strategy of the construction organization, and then into strategic plans and programs. Thirdly, the study of the structural components of the integral index of competitiveness in
dynamics will reveal the structural patterns of the competitive environment of the investment and construction market. Such patterns can form the basis of a forecast of the development of a competitive environment [21]. If steady trends and patterns are detected, the uncertainty of such forecast can be significantly reduced.

Summary
Summarizing the above, it is necessary to emphasize that the practical use of the methodical tools discussed above requires appropriate organizational support. It seems necessary to organize a permanent monitoring of the competitive environment of the investment and construction market. At the same time, fairly broad functions should be given to monitoring, which actually correspond to its essence. Monitoring as a tool of strategic management in general and strategic management of the construction organization’s competitiveness in particular should be viewed as a combination of three types of actions: observation, analysis and forecasting, thereby expanding its meaningful content [22]. The technology of such monitoring will require the organization of continuous monitoring of the structure of the competitive environment of the investment and construction market, measurements of particular competitiveness indexes for its main representatives and for individual sectors of the competitive environment, definition of integral indexes of competitiveness. In this technology, all analytical and prognostic procedures provided by the method of engineering forecasting will take their place, and their results will make it possible to form strategic decisions that take into account the complexity and ambiguity of the competitive processes taking place in the investment and construction complex and reliably assess the prospects for their development.

The strategic nature of monitoring the competitive environment of the investment and construction market necessitates the creation of a unit responsible for monitoring at the management level, empowered to form the adoption of strategic decisions. At the same time, it is accompanied by a significant amount of analytical work carried out in the current mode and combined with the performance of strategic functions [23]. This feature of monitoring the competitive environment can be realized by forming a competitiveness monitoring center in the organizational structure of the construction organization's management system, a relatively independent unit that interacts with units of different hierarchical levels (strategic, tactical and operational). The functionality of this center should combine various management functions, but with a clearly defined focus on the formation of strategic decisions in the field of competitiveness management. It is important to emphasize that such decisions will not only acquire the property of methodological validity, which is due to a combination of analytical and prognostic components and the possibility of using a multi-factor model for assessing competitiveness, but also approach the implementation conditions - the dynamic conditions of the investment and construction market. At the same time, the Center for Monitoring Competitiveness becomes the center of decision making and the center of responsibility for their successful implementation. The activity of this center, in case of its full compliance with the methodology of monitoring the competitive environment, will allow solving one of the key management issues - achieving organic unity between theory and practice.

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