Tools development for estimated cost management of construction and assembly works

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Abstract. In general, construction costs are governed by the federal law № 44-FZ CONCERNING THE PROCUREMENT CONTRACT SYSTEM OF GOODS, WORKS AND SERVICES FOR STATE AND MUNICIPAL NEEDS (in force 05 April 2013) and the federal law №223-FZ CONCERNING THE PROCUREMENT OF GOODS, WORKS AND SERVICES BY SEPARATED TYPES OF ENTITIES (in force 18 July 2011) as well. A method, which is more applicable in practice and presented in the laws mentioned above – is the calculation of estimated working costs. In order to calculate total costs and economic effects for an enterprise correctly, it is possible to use such tools, as complex estimation, active examination and cost modelling processes. It is important to add specific costs which are peculiar to this particular object into calculation of total costs and effectiveness. Modelling will be applied well for calculation of capital construction cost. A positive economic effect from the application of new methods and approaches is expected due to the accuracy of the cost estimates and cost projections will increase.

1. Introduction
Correct approach to value management plays a vital part in modern economic systems. Construction market value is mainly governed by the federal law № 44-FZ [1], and the federal law №223- FZ [2] as well. A method, which is more applicable in practice and presented in the laws mentioned above – is calculation of estimated working costs.

2. Relevance
Importance of determination of works budget valuation at pre-investment stage, according to the Government degree №87 [3], makes organizations difficult to determine the estimated cost of the object, because of Existing Collections of Estimated Prices and estimated standards in general [4-14] imply either a sufficiently detailed list of the scope of work, or a completed project. But it is hard to estimate such types of works completely and correctly at pre-investment stage. In this case it is important to work out a special tool, which will allow calculating estimated costs based on technical task initial data quickly.
3. Scientific significance
Generally, development of one more extra tool for estimated cost calculation will have positive influence on construction pricing. It will lead to solving a few current questions estimated rationing such as:

1. A variety of counting methods will allow different companies to apply the most convenient way.
2. The duration of budgeting at the pre-investment stage will be reduced
3. New approach will be easy to use not only by high-qualified specialists of this business field, but also by related industries specialists, for instance by specialists of tender departments;
4. The calculations transparency of construction cost in the initial stages will rise;
5. Works value difference on stage «project» and on stage "working documentation" will be minimized due to all related works will be taken into consideration in block-diagrams expected.

4. Theoretical part
At the present stage, the accounting of actual costs in the estimated calculations is relevant. For several years, some solutions to this problem have been proposed, particularly: object total value calculation and the cost of work quality checking by cost engineering as mandatory addition [15], inclusion of construction risk costs in the work valuation and other future possible costs [16], high cost of individual estimated standards development [17], accounting of object real complexity [18], more detailed calculation of the inflation index to the estimated cost of construction and installation works [19], the correct determination of the construction products cost in the estimates [20]. Moreover, there are normative approaches for calculating of objects estimated costs, such as: base index, resource, resource index, base countervailing. Last two methods copy basic-indexed and resourced methods provisions in 80%. Therefore, this significantly narrows the circle in the ways of determining the of various objects construction cost. It is important to use the resource method for some construction projects, for instance – road construction (original cost of special equipment, macadam, bituminous concrete, asphaltic bitumen etc. calculates). For other objects it is more acceptable to use the base index method, due to it allows determining the estimated cost of construction and installation works as soon as possible. According to the definition of resource method, which is published in THE COST CALCULATION METHOD OF BUILDING OBJECTS CONSTRUCTION IN THE RUSSIAN FEDERATION, it is important to estimate present value of each resource, which was taken into account in unit cost. This means, that the construction cost will be much more believable, but budgeting will be longer. At the same time, in 90% of cases, estimates should be made quickly for a wide range of reasons.

Base index method solved the second task – compilation speed, but not the accuracy of the compilation because of serious calculation errors in 50% of cases. According to THE COST CALCULATION METHOD OF BUILDING OBJECTS CONSTRUCTION IN THE RUSSIAN FEDERATION, base index method involves multiplying the base cost of resources, which are included in unit cost, by the inflation index, which identifies by Russian Ministry of Construction every quarter and other authorized firms which regulate the relationship between customers and contractors in the estimated cost. The main disadvantage of this method is the uneven inflation of each unit cost component. In other words, the final current estimated cost is determined by an inflation index for the material, wages and equipment only. It does not take into account that power outlet cost has changed in its trend for 18 years different from changes of copper cables cost. Nevertheless, an inflation index for both materials is the same. Finally, it affects the final value of the object, which is doubtful and non-reflective modern market value of construction and installation works.

There are stages of the construction process in which the application of both these methods is inconvenient. Striking examples are costing process in the period of tender documents preparation by a tenderer and costing process in the period of preparation design specifications and estimates at the project documentation stage (according to the Government degree №87). The base index and resource methods do not meet all the calculation requirements in both cases because of their application implies
a clear specification of the work scope, a certain amount and brands of the necessary materials and equipment for the implementation of this object.

Generally, bid evaluation process takes place by awarding points to the Contractors. The winner becomes the participant who received the maximum possible points from the following parameters: the lowest price; company’s life; the number of contracts concluded with this company; timely tax payments; personnel qualified; company reputation among government agencies; company annual revenue; fixed assets; nonavailability personnel outsourcing, etc. According to the awarded points, the importance of each parameter is correlated with each other in order to get a comprehensive assessment of the procurement participant.

Generally, the lowest price is the main parameter with the highest weighting factor. This element gives an opportunity to win that participant, who has announced the lowest price, even if this price is less than working costs of this Customer. In this case, it is important to calculate all the costs correctly on the project documentation stage or according to preliminary specifications.

Modern methods of estimated rationing do not meet all the requirements of project documentation for original price calculation. Therefore, a modern approach to determining costs at the initial investment stage is important to be developed. Moreover, there is a problem of estimated cost evaluation by experts – lack of highly qualified specialists of the estimated rationing and evaluation of procurement participant proposals.

The work on checking the documentation by experts requires a considerable amount of time and material costs for the preparation of tender documentation. There is a high degree of subjectivity in the examination process at this stage, because modern estimated standards can be interpreted in different ways. For instance, the same rate can be applied to objects of different purposes. Only a highly qualified specialist will be able to see the presence of incorrect prices in local estimates. All of this complicates the work of commercial departments, departments for procurement documentation due to lack of staff skills. Therefore, it is important to create a method for evaluating investment projects, which will allow the specialist of the tender department to calculate the initial minimum value of the object without having the exact amount of work, moreover, without material damage to the contracting company.

Abroad there are about a dozen methods for calculating estimated project costs. Most of them are repeatedly adjusted during construction process for compliance with the fact. In the Russian Federation, for that objects whose value is not determined by the 44-FZ [1] or 223-FZ [2], in case of additional works, which are not accounted for by the design decisions, but arisen during the construction process, it is allowed to make an additional extra working costs agreement. But what about builders, who construct objects and whose value is determined by the 44-FZ [1] or 223-FZ [2]? What they have to do in the same situation, when unforeseen expenses increased more than 2% for housing and civil construction and 3% for industrial buildings and facilities during the construction process?

In order to determine working costs and the economic effect for the enterprise correctly, it is necessary to use new tools to solve this problem, particularly, complex estimation, active examination and cost modelling processes. By applying the listed tools in practice, it is possible to more accurately determine the real working costs and the reasonable efficiency of the object being realized, ensuring a net profit not lower than the calculated level.

5. Practical implementation

It is important to add specific costs into calculation of total costs and effectiveness estimation, which are peculiar to this particular object. This model is not integrating costing standards because when specialists will apply it, they will not be guided by an analogue object. The model will independently adapt to the object, taking into account all the features. Model application is proposed to be carried out on the basis of the electric power industry, as one of the industries related to the costs of research and development. The following works, which are related to this multifaceted industry will be described: work related to automated information systems for electricity commercial metering, automated
information systems for technical management, automated systems for managing energy resources, automated systems for managing technical processes and other developments related to technological processes automation, their accounting and availability of reducing power consumption systems.

Finally, worked out method of model constructing can be used not for the electric power industry, but also for other building and installation works, which are calculated on the basis of costing standards. Nevertheless, for practical implementation of this model for other building and installation works it is necessary to work out analog models with extra parameters which will satisfy the requirements all particular construction and installation works. It should be noted that it will be necessary to perform a number of similar calculations with the identification of changes in rates, reasons for changes in prices, the most applicable materials and equipment with such installation. Moreover, it is also required to take into account the actual number of machine-hours of the rented technical to regulate the coefficient on the labor costs of machine operators and machines. This ratio is supposed to be determined by complex estimation mechanisms (nextly CEM), in order to calculate the most adequate index.

The CEM will allow applying the coefficient, which takes into account all possible complexity factors and risks associated with the construction in the model. In this case, the amount of risk and risk calculation will be transparent. Therefore, it would be easier for a customer to determine if the Contractor had the same costs and, if so, whether these costs are validated by the working hours. In modern pricing risk magnitude is regulated by THE COST CALCULATION METHOD OF BUILDING OBJECTS CONSTRUCTION IN THE RUSSIAN FEDERATION. By the way, according to modern practice of risk management in construction, the amount of money received from these unforeseen expenses does not fully cover the additional construction and installation work. It will lead to distortion of contractor’s working costs and, as a result, to distortion of new fixed asset value for Customer. Therefore, depreciation accounting, property tax payments, taxation of profits and wages etc. will be incorrect. Object life cycle process and CEM’s application are presented on the Figure 1.

![Figure 1. Costing process.](image)

Comprehensive examination (nextly CE) will be applied after value calculation, which is determined according to an estimate documentation (nextly ED) for this particular object. Its importance for calculation of the estimated working costs is due to the need to justify the differences with the minimum and / or maximum costs determined by the object model, taking into account specific complexity factors, as can be seen from Figure 2:

![Figure 2. Importance of the lowest price.](image)
6. Conclusion

Modelling process is well applicable for calculation of construction project value. Application of this method can be described by three features of novelty:

- Creation of "the lowest price" templates – availability of necessary costs and work per unit of the process;
- Application of integrated assessment mechanisms in modelling process, which take into account the specificity and individuality of the object;
- Justification of "the lowest price" deviations, which arose due to creation of object estimates according to the "active examination" principle.

In general, a positive economic effect will be obtained from the application of new methods and approaches, since not only the accuracy of valuation and cost projections will increase, but the following important results will be obtained:

- unscrupulous contractors, who unduly overestimating budgets, will leave the market. Therefore, working costs and marginal profit of enterprises will become “transparent” and homogeneous for similar objects with similar-sized firms;
- reduction of the corruption component in the conclusion of contracts for construction and installation works;
- new government informational system (GIS) operating is relevant and important components for regulating the cost of building resources;
- the new method will allow to test the estimated cost of construction and installation works at the “project documentation” stage, at the stage of submitting a commercial proposal by tender participation (44-FZ), and during the investment justification period as well.

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