

THE TECHNIQUE OF MULTI-CRITERIAL AND MULTI-LEVEL ASSESSMENT OF CONTRACT QUALITY UNDER UNCERTAINTY

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Аннотация. В статье рассматривается методика многокритериальной и многоуровневой оценки качества контрактов, описывается порядок проведения оценки, особенности построения функций желательности частных критериев, проводится сравнение с методом анализа иерархий.

Abstract. The article discusses the technique of multi-criteria and multi-level assessment of the quality of contracts, describes the procedure of assessing, the features of constructing desirability functions of private criteria, a comparison is made with the analytic hierarchy process.

Currently, the high quality of any activity is of great importance for enterprises. Quality assessment system is a prerequisite for the certification of quality management systems.

The technique of multi-criteria assessment of the quality of commercial contracts developed by the authors was tested at the JSC «Mogilev Metallurgical Works». It should be noted that the technique, which was previously used by specialists of the commercial department of JSC «MMW», based on the analytic hierarchy process (AHP), has a number of significant drawbacks.

First, this technique gives a possibility to assess only one level of factors, which is not always enough to make a rational decision. Sometimes the model contains a large number of factors of several levels.

Second, assessments of the quality of factors do not always correspond to reality. They can be overestimated or underestimated, since there is no best and worst value of the estimated factor.

Thirdly, serious problems arise in determining the weight coefficients, since it is difficult for an expert to single out the most significant factors of their totality and adequately rank them.

Fourth, the technique does not show which of the factors have the greatest influence on the quality and does not allow to assess the degree of this influence.

Fifth, the option is selected on the base of the maximum sum, which is not always true. It is possible that the factor with the highest weight will receive the highest value, while other factors with lower weights will have very low values.

Finally, sixth, the technique does not show how high the quality of the evaluated contract is in comparison with the «ideal contract» (100% quality).

It should be mentioned that any process is characterized by the set of conflicting private criteria. Moreover criteria are often set verbally in the form of statements, which introduces uncertainty in the problem being solved.

Concluding a contract is a process that has a result (a contract), therefore, it is possible to build a cause-effect diagram for this process proposed by the Japanese scientist Kaoru Ishikawa. To build a diagram, it is necessary to find the factors that influence the result of the process and to identify the secondary factors that affect the factors of the first level.

First of all, the result is determined: it is the quality of the contract. Specialists of the commercial department conducted a brainstorming session to identify the primary and secondary factors. The following conditions of the contract were identified as significant factors: the amount of the contract; terms of delivery; terms of payment; product quality; sanctions.

In turn, for each primary factor, factors of the second level were identified:

- for the amount of the contract: amount of delivery and price;
- for terms of delivery: basic terms of delivery and price;
- for the terms of payment: method, currency and time of payment;
- for product quality: quality and price;
- for sanctions: the timing of the sanctions and interest on penalties.

Desirability functions are used in the developed technique to formalize the factors identified by the specialists of JSC «MMW». The desirability functions for the factors were constructed taking into account the constraints imposed by economic conditions or dictated by considerations of economic benefits.

There are restrictions for the factor «Amount of delivery» on the minimum (dictated by considerations of economic benefits) and maximum (due to limited production capacity). In addition, there is the most desirable batch size that provides the optimum cost for preparing that batch.

The type of function for the factor «Price» is determined by the minimum cost of the product.

For the factor «Terms of delivery» reference points correspond to the conditions of Incoterms. The terms of delivery are listed in ascending order of costs and responsibilities of the seller. The function is presented as a table, where the values of the desirability function for each condition are indicated.

For the factor «Product quality» the following reference points are distinguished: compliance of quality with state standards, compliance of quality with technical specifications, compliance of quality with ISO-9000. It should be noted that manufacturing of high quality products requires higher costs for setting up equipment, for incoming quality control and outgoing quality control.

For the factor «Interest on penalties» a desirability function is constructed from the point of view of the seller, the form of which is explained by the fact that the seller is interested in the minimum amount of sanctions imposed on him.

The desirability function of the factor «Timing of the sanctions» shows that it is beneficial for the seller that sanctions for late delivery of products come as late as possible, since there may be unforeseen delays in the shipment.

For the factor «Currency of payment» the desirability function is presented in a tabular form. The better the currency is converted, the more profitable it is for the seller.

For the factor «Method of payment» the desirability function values are presented in a tabular form. The desirability of a method depends on the time of payment and the reliability of the payment method.

The desirability function of the factor «Time of payment» shows that the earlier payment is received, the better it is for the seller.

To analyze information related to the cause-effect diagram and desirability functions specific methods should be used to determine the degree of influence of a factor on the result. These methods include the determination of the coefficients of the relative importance of private criteria in terms of their contribution to the quality indicator at a higher level of the cause-effect diagram.

During the brainstorming the experts of JSC «MMW» performed a pairwise comparison of the importance of the factors of the first and second levels and filled in the matrices of pairwise comparisons according to AHP.

When evaluating contracts it is advisable to use different types of global criteria, since the use of only an additive criterion, which compensates the low values of some private criteria at the expense of the high values of others, can lead to inadequate decisions. That is why the obligatory use of additive criterion is the disadvantage of the AHP. In addition when using AHP and a new alternative appears, it is necessary to rebuild the matrices of paired comparisons. With the large number of alternatives the construction of matrices seems unrealistic. The next drawback of the AHP is that the numerical characteristics (e.g. price per ton) had to be converted into qualitative comparative estimates using only nine discrete numbers, which led to a significant loss of information.

The performed analysis testifies to the advantages of the developed technique for solving multicriteria multilevel problems, which is free from the noted disadvantages of the widely used analytic hierarchy process.

Список литературы

1. Жесткова, Е.С. Формирование целевой функции при многокритериальной оптимизации экономических объектов / Е.С. Жесткова, В.А. Широченко // Вестник Могилевского государственного технического университета. – 2005. – № 1(8). – С. 79–83.
2. Жесткова, Е.С. Оценки качества продукции по методике многокритериального анализа // Веснік Могілёўскага дзяржаўнага ўніверсітэта імя А. А. Куляшова. – 2000. – № 2–3(6). – С. 83–88.