MODIFIED MULTI-CRITERIA DECISION MAKING METHOD
DEVELOPMENT BASED ON "AHP" AND "TOPSIS" METHODS USING
PROBABILISTIC INTERVAL ESTIMATES

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ABSTRACT
Based on the previous analysis of multi-criteria decision-making methods (in particular, "SAW",
"TOPSIS", "ELECTRA" and "Analytic Hierarchy Process" ("AHP")), we revealed their general
disadvantage in the form of a sufficiently high subjectivity of the initial estimates for calculations, which
led to a distortion of the final results and can lead to an erroneous management decision. In order to
minimize the influence of the subjective factor, we offered a modified method, the essence of which was
the use of probabilistic interval estimates. At the same time, the indicator weights are found by pairwise
comparisons, since such a comparison of indicators is intuitively understandable and gives a fairly
accurate result. Then, for the probabilistic interval estimates, the mathematical expectation is calculated
to construct the matrix of expert estimates, where the mathematical expectation is a mean value of the
random value (the value indicated is the expert estimate value). The positive and negative decisions,
taking into account the indicator weights, are determined under the matrix of expert estimates. The
supplier's rating is based on the degree of approximation of its final evaluation to a positive decision. The
advantage of the modified method is in the fact that the expert estimates calculated on
the basis of probability intervals are more approximate to the reflection of the features of real-world objects in
comparison with the expert point estimates.

Keywords: choice of the supplier, multi-criteria methods, enterprise management, mathematical methods,
optimization.

INTRODUCTION
The effective inventory management is an urgent task for the commercial organizations. In many respects
the effectiveness of task solution depends on the choice of the supplier, its capabilities and the quality of
business relations. The enterprises apply not only qualitative, but also quantitative methods to select the
most profitable and responsible supplier.

There are the following quantitative methods, which are the most common: "SAW", "TOPSIS",
"ELECTRA" and "Analytic Hierarchy Process". The most promising methods have a number of
advantages and disadvantages:

a) The advantages of the "TOPSIS" method are ease of application, universality, consideration of
distances to an ideal solution; significant disadvantages - high subjectivity.

b) The advantages of the "Analytic Hierarchy Process" ("AHP") are universality, reduction of subjectivity
due to the consideration of the human factor, verification of data inconsistency; the disadvantages - high
labor input, large amount of initial data, limited nature of the assessment scale.

Based on the results of a comparative analysis of multi-criteria methods for choosing the suppliers, taking
into account their advantages and disadvantages, we offered a modified method based on the "AHP" and
"TOPSIS" methods. In order to reduce subjectivity in the uncertainty conditions for finding the weights of
the criteria, we decided to use the algorithm of the "AHP" method. Unlike the "TOPSIS" method, the new method can be used in the case where the weight ratios are unknown in advance.

**TEXT OF ARTICLE**

The algorithm of the modified method of multi-criteria decision-making includes the following stages:

1. Finding the indicator weights.

The calculation is similar to the AHP method. The indicator weights are found by pairwise comparison of the elements $u_{ij}$ of the matrix of comparative estimates of weights $U$:

$$U = \begin{pmatrix}
1 & u_{12} & \cdots & u_{1k} \\
\frac{1}{u_{12}} & 1 & \cdots & u_{2k} \\
\vdots & \vdots & \ddots & \vdots \\
\frac{1}{u_{1k}} & \frac{1}{u_{2k}} & \cdots & 1
\end{pmatrix}, \quad (1)$$

where the relation $u_{ij} = \frac{1}{u_{ji}}, u_{ji} \neq 0$ is performed for any $i$ and $j$.

The elements of matrix diagonal are equal to 1.

To establish the criteria values, it is used a relative importance scale (Table 1) [1]:

<table>
<thead>
<tr>
<th>Relative importance intensity</th>
<th>Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
</tr>
<tr>
<td>3</td>
<td>Moderate superiority</td>
</tr>
<tr>
<td>5</td>
<td>Substantial superiority</td>
</tr>
<tr>
<td>7</td>
<td>Significant superiority</td>
</tr>
<tr>
<td>9</td>
<td>Very strong superiority</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate judgments</td>
</tr>
</tbody>
</table>

To determine the consistency of estimates, it is necessary to determine: maximum eigenvalue $\lambda_{\text{max}}$, consistency index (CI) and consistency ratio (CR).

The maximum eigenvalue is found by the formula [2]:

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\[ \lambda_{\text{max}} = \sum_{i=1}^{k} \lambda_{i}, \quad (2) \]

where \( \lambda_{i} = \sum_{j=1}^{k} u_{ij} y_{ij}^{H} \). \quad (3)

\( y_{ij}^{H} \) - a component of the normalized priority vector, representing the aggregate expert opinions, which are determined by dividing the mean geometric for each indicator by the amount of mean geometric of all indicators.

The consistency index (CI) and the consistency ratio (CR) are calculated by the formulas [1]:

\[ HC = \frac{\lambda_{\text{max}} - k}{k - 1}, \quad (4) \]

\[ OC = \frac{HO}{CC}, \quad (5) \]

where \( CC \) – a mean value of a random consistency index.

The generalized supplier priorities are found with an acceptable value of the consistency ratio; at that, the indicator weights are assumed to be calculated.

This method was chosen to calculate the indicator weights, since it is the easiest way to determine the importance of a particular indicator by comparing each indicator with others. The complexity of calculations by this method significantly increases with an increase in the matrix dimension, which complicates the calculations of the potential supplier ratings. The indicators are usually in a somewhat smaller amount in addition, the most important of them can be selected for analysis.

In general, the modified method makes it possible to accurately calculate the quantitative expression of the indicator weights.

2. Provision of expert estimates.

The expert specifies the estimate intervals on a ten-point scale for each supplier and indicator; at that, the probability is given for each interval. Let us assume that \( C = \{c_{i}\} \) – set of estimated indicators, \( A = \{a_{j}\} \) – set of potential suppliers, set of experts – \( B = \{b_{k}\} \). Let us assume that \( I \) – number of indicators, \( J \) – number of potential suppliers, \( K \) – number of experts; then the number of expert estimated is determined as their derivate:

\[ Q = I \cdot J \cdot K. \quad (6) \]

Each expert estimate is not a discrete value, but a set of intervals, each of which has its own probability. The number of intervals is not fixed for each expert estimate. Each interval has an expert-specified minimum and maximum value, as well as the probability of estimate occurrence in this interval. Let us assume that the expert estimate is a matrix with \( n \) rows. Then the minimum value of each next interval is strictly less than the maximum value of the current interval: \( \max(x_{n-1}) < \min(x_{n}) \).
Let us assume that \( p_i \) – the probability of estimate's belonging to the interval. Since each interval element is a discrete estimate, the intervals are reduced to the discrete series. The following assertion is true for each element of a discrete series: \( 1 \leq x_i \leq 10 \), in this case, \( x_i \) an element of a discrete series has a probability of \( p_i \). At the same time, each element of the series satisfies the condition: \( x_{i-1} < x_i < x_{i+1} \).

It is determined a total probability:

\[
P = \sum_{i=1}^{n} p_i, \quad (7)
\]

Then the probabilities are reduced to the normalized form:

\[
p_{0i} = \frac{p_i}{\sum_{i=1}^{n} p_i}, \quad (8)
\]

where \( p_{0j} \) – normalized probability of \( x_i \)-th element of the series.

The following assertion is true for a normalized series:

\[
\sum_{i=1}^{n} p_{0i} = 1, \quad (9)
\]

The mathematical expectation \( M(x) \) is calculated by the formula:

\[
M(x) = \sum_{i=1}^{n} x_i p_{0i}, \quad (10)
\]

The mathematical expectation of a random value characterizes the mean value of a random value. The mathematical expectation is referred to the so-called features of situation distribution (to which the mode and the median also belong). This feature describes a certain averaged position of a random value on a numerical axis [3]. The mathematical expectation is the first central moment of a random value.

After having repeated the mathematical expectation calculation for all probabilistic interval estimates (that is, \( Q \) times), it turns out that each supplier has a vector consisting of the mathematical expectations of each expert for each indicator:

\[
M = \{m_1, \ldots, m_j\}, \quad (11)
\]

According to this vector, the final evaluation of the supplier is calculated according to a given indicator according to the formula:

\[
\bar{m} = \frac{\sum_{i=1}^{n} m_i}{n}, \quad (12)
\]
This value $\bar{m}$ is used to build a matrix of expert estimates for all suppliers and indicators.

Then it is built the matrix of expert estimates $\bar{M}$, where $\bar{m}_{ij}$ – the indicator value $c_i$ for the supplier $a_j$:

$$
\bar{M} = \begin{pmatrix}
\bar{m}_{11} & \bar{m}_{12} & \cdots & \bar{m}_{1n} \\
\bar{m}_{21} & \bar{m}_{22} & \cdots & \bar{m}_{2n} \\
\cdots & \cdots & \cdots & \cdots \\
\bar{m}_{m1} & \bar{m}_{m2} & \cdots & \bar{m}_{mn}
\end{pmatrix}, \quad (13)
$$

The variance characterizes the spread of values of a random value with respect to its mathematical expectation [4]:

$$
D(x) = \sum_{i=1}^{n} x_i^2 p_{0i} - \left( \sum_{i=1}^{n} x_i p_{0i} \right)^2. \quad (14)
$$

The variance shows how the values are concentrated and grouped around $M(x)$ on average: if the variance is small, the values are relatively close to each other, if large - far from each other [5]. The variance is the second central moment of a random value.

If a random value describes physical objects with a certain dimension (pieces, kilograms, etc.), then the variance will be expressed in square units. Since this is inconvenient for analysis, we also calculate the variance root – the mean square deviation $\sigma(x)$, which has the same dimension as the original value and also describes the spread [6]:

$$
\sigma(x) = \sqrt{D(x)}. \quad (15)
$$

The mean square deviation can be used to estimate the adequacy of the intervals specified by the expert. It is possible to calculate the limit value $\sigma(x)$ at which the expert estimates will be admissible. If the value $\sigma(x)$ exceeds the permissible value, then it is considered that the expert has set the intervals incorrectly. This situation can arise, if the expert finds it difficult to determine the estimated intervals and cannot set narrow limits. The example is presented in Table 2.

**Table 2 - Example of affixing estimates including probabilities**

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>0.95</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>0.05</td>
</tr>
</tbody>
</table>

As can be seen from the table, the value of the second interval is too large in comparison with the scale of estimates. The value $M(x) = 6.27972$, when $\sigma(x) = 2.181953$. Since the estimate $m_i$ can actually take any value from the interval:
\[ M(x) - \sigma(x) \leq m_i \leq M(x) + \sigma(x) \], that is, \[ M(x)_{\text{min}} \leq m_i \leq M(x)_{\text{max}}, \quad (16) \]

we receive:

\[ M(x)_{\text{min}} = M(x) - \sigma(x) = 4,097768, \]
\[ M(x)_{\text{max}} = M(x) + \sigma(x) = 8,461673. \]

For the estimate \( m_i \) it is true to say that it can take limit values that are fundamentally capable of influencing the supplier's rating, as can be seen from the calculation results.

3. Determination of the supplier rating.

Let us assume that there is a matrix of expert estimates of the indicators: \( \overline{M} \).

The indicator estimates are transferred into a dimensionless form by the formula:

\[ p_{ij} = \frac{m_{ij}}{\sqrt{\sum_{j=1}^{n} m_{ij}^2}}, \quad (17) \]

It is calculated the matrix of normalized indicator values:

\[ P = (p_{ij}). \quad (18) \]

It is built a matrix of weighted indicator values; at that, the weights satisfy the following condition: \( w_i \in [0,1] \).

It is calculated the matrix of normalized weighted values:

\[ \tilde{P} = (w_ip_{ij}) = (\tilde{p}_{ij}). \quad (19) \]

It is found the most positive solution:

\[ A^+ = (\max(\tilde{p}_{11}), \ldots, \max(\tilde{p}_{1n})) = (\tilde{p}_{1}^+, \ldots, \tilde{p}_{n}^+), \quad (20) \]

It is found the most negative solution:

\[ A^- = (\min(\tilde{p}_{11}), \ldots, \min(\tilde{p}_{1n})) = (\tilde{p}_{1}^-, \ldots, \tilde{p}_{n}^-). \quad (21) \]

It is determined the deviation of indicator estimates from the most positive solutions:

\[ S_j^+ = \sqrt{\sum_{j=1}^{n} (\tilde{p}_{ij} - \tilde{p}_{ij})^2}, \quad j = 1, n, \quad (22) \]

It is determined the deviation of indicator estimates from the most negative solutions:
The supplier estimates are determined by the formula:

\[ S_j^{-} = \sqrt{\sum_{j=1}^{n} (\tilde{p}_i - \tilde{p}_{ij})^2}, j = 1, n. \quad (23) \]

The supplier estimates are determined by the formula:

\[ p_j^+ = \frac{S_j^-}{S_j^+ + S_j^-}. \quad (24) \]

These estimates represent a quantitative expression of proximity to the most positive solution.

The last step is ranking the supplier estimates in such a way that the following condition is met: 
\[ p_1^+ \leq p_2^+ \leq \ldots \leq p_j^+. \]

As a result, it is true to say for each estimate \( p_j \) that its rank is equal to \( j \). Thus, the supplier with the best estimate is on the first place of the rating, and the supplier with the worst estimate is in the last place.

Then there is an example of calculating the supplier rating using a modified method.

There are 5 potential suppliers that are considered for the inventory supply. The weight ratios of the supplier evaluation criteria were calculated by the "Analytic Hierarchy Process". The resulting weight ratios are shown in Table 3.

\textbf{Table 3} - Values of the weight ratios calculated by the "AHP" method

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product quality</td>
<td>0.267</td>
</tr>
<tr>
<td>Price</td>
<td>0.222</td>
</tr>
<tr>
<td>Timely supply</td>
<td>0.157</td>
</tr>
<tr>
<td>Supplier's image</td>
<td>0.125</td>
</tr>
<tr>
<td>Discounts and bonuses</td>
<td>0.125</td>
</tr>
<tr>
<td>Location</td>
<td>0.104</td>
</tr>
<tr>
<td>Total</td>
<td>1.000</td>
</tr>
</tbody>
</table>

As input data, the estimates of one expert will be used to reduce the complexity of calculations. Interval criteria estimates for the first supplier are presented in Table 4. Similar estimates are made for other suppliers.

\textbf{Table 4} - Interval estimates including probabilities for the Supplier A

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Min</th>
<th>Max</th>
<th>Probability</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Product quality</th>
<th>6</th>
<th>8</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Price</td>
<td>5</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>Timely supply</td>
<td>2</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>8</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Supplier's image</td>
<td>3</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>55</td>
</tr>
<tr>
<td>Discounts and bonuses</td>
<td>4</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>Location</td>
<td>2</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

The interval estimates are then reduced to a discrete series. Table 5 includes a discrete series of estimates indicating the probabilities for the "Product quality" criterion for the Supplier A.

**Table 5** - Reducing the intervals to a discrete series indicating the estimate probabilities

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

The probability values are reduced to the normalized form by the formula (17).

**Table 6** - Normalized element probabilities

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.091</td>
<td>0.091</td>
<td>0.091</td>
<td>0.364</td>
<td>0.364</td>
</tr>
</tbody>
</table>

Calculation of the mathematical expectation $M(x)$:

$M(x) = 1 \times 0 + 2 \times 0 + 3 \times 0 + 4 \times 0 + 5 \times 0 + 6 \times 0.091 + 7 \times 0.091 + 8 \times 0.091 + 9 \times 0.364 + 10 \times 0.364 = 8.8182.$

Variance calculation $D(x)$:
\[ D(x) = (1 \times 1 \times 0 + 2 \times 2 \times 0 + 3 \times 3 \times 0 + 4 \times 4 \times 0 + 5 \times 5 \times 0 + 6 \times 6 \times 0.091 + 7 \times 7 \times 0.091 + 8 \times 8 \times 0.091 + 9 \times 9 \times 0.364 + 10 \times 10 \times 0.364) - 8.8182 \times 8.8182 = 1.6033. \]

Calculation of the mean square deviation \(\sigma(x)\):

\[ \sigma(x) = 1.2662. \]

Thus, the value of the "Product quality" criterion for the Supplier A can deviate by 1.2662 points.

The calculation of the remaining criteria is similar.

The results of calculating the mathematical expectations for the criteria estimates are given in Table 7.

**Table 7 - Calculation of mathematical expectations**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mathematical expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplier A</td>
</tr>
<tr>
<td>Product quality</td>
<td>8.818</td>
</tr>
<tr>
<td>Price</td>
<td>7.200</td>
</tr>
<tr>
<td>Timely supply</td>
<td>5.708</td>
</tr>
<tr>
<td>Supplier's image</td>
<td>5.122</td>
</tr>
<tr>
<td>Discounts and bonuses</td>
<td>6.737</td>
</tr>
<tr>
<td>Location</td>
<td>4.000</td>
</tr>
</tbody>
</table>

Then, according to the "TOPSIS" method, we calculate the supplier rating taking into account the relative proximity to the ideal-positive solution. By reducing the estimates into a dimensionless form and multiplying by the weight ratios, we obtain a table of weighted normalized estimates (Table 8).

We obtained the weighted normalized estimates of alternatives using the weight ratios.

**Table 8 - Weighted normalized estimates of alternatives**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Weight criterion for the estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Supplier A</td>
</tr>
<tr>
<td>Product quality</td>
<td>0.267</td>
<td>0.175</td>
</tr>
<tr>
<td>Price</td>
<td>0.222</td>
<td>0.146</td>
</tr>
<tr>
<td>Timely supply</td>
<td>0.157</td>
<td>0.064</td>
</tr>
</tbody>
</table>
The distances to an ideally positive solution are shown in Table 9.

**Table 9 - Determination of distances to the ideally-positive solution**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplier A</td>
</tr>
<tr>
<td>Product quality</td>
<td>0.000</td>
</tr>
<tr>
<td>Price</td>
<td>0.000</td>
</tr>
<tr>
<td>Timely supply</td>
<td>0.001</td>
</tr>
<tr>
<td>Supplier's image</td>
<td>0.000</td>
</tr>
<tr>
<td>Discounts and bonuses</td>
<td>0.000</td>
</tr>
<tr>
<td>Location</td>
<td>0.001</td>
</tr>
<tr>
<td>$S^+$</td>
<td>0.050</td>
</tr>
</tbody>
</table>

The distances to an ideally negative solution are shown in Table 10.

**Table 10 - Determination of distances to the ideally-negative solution**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supplier A</td>
</tr>
<tr>
<td>Product quality</td>
<td>0.022</td>
</tr>
<tr>
<td>Price</td>
<td>0.010</td>
</tr>
<tr>
<td>Timely supply</td>
<td>0.001</td>
</tr>
</tbody>
</table>
The results of calculations of the supplier ratings are reflected in Table 11.

### Table 11 - Supplier ratings calculated using the modified method

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Supplier A</th>
<th>Supplier B</th>
<th>Supplier C</th>
<th>Supplier D</th>
<th>Supplier E</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P^+$</td>
<td>0.788</td>
<td>0.412</td>
<td>0.362</td>
<td>0.563</td>
<td>0.486</td>
</tr>
</tbody>
</table>

**METHODS**

During the study, the authors used the following methods:

1. Selective analysis of specialized literature with a high citation index for the subject matter indicated in the title of this article. In particular, we identified the disadvantages of the "SAW", "TOPSIS", "ELECTRA", "AHP" methods.

2. We offered a way for overcoming the shortcomings of existing multi-criteria methods by modifying them, in particular, on the basis of the "TOPSIS" and "AHP" methods using the probability intervals of expert estimates.

3. The proposed solutions were formalized in the form of a methodology to ensure their unambiguous interpretation.

**RESULTS**

1. The essence of the modified method of multi-criteria decision-making is to use the probabilistic interval estimates. At the same time, the indicator weights are found by pairwise comparisons, since such a comparison of indicators is intuitively understandable and gives a fairly accurate result.

2. The positive and negative decisions, taking into account the indicator weights, are determined under the matrix of expert estimates. The supplier's rating is based on the degree of approximation of its final evaluation to a positive decision.

3. The advantage of the modified method is in the fact that the expert estimates calculated on the basis of probability intervals are more approximate to the reflection of the features of real-world objects in comparison with the expert point estimates. The interval estimates allow taking into account the problem of an accurate expert estimate due to the lack of complete information on the supplier. The expert can operate with estimates of the indicators within a certain interval and indicate the probabilities of getting a real estimate in this interval. In the final analysis, this increases the data accuracy for the subsequent calculations.
DISCUSSION
The disadvantages of the modified method include subjectivity of certain probabilities, because the expert himself determines the probability of getting the estimate in the specified interval. In addition, if the expert assigns too large interval in comparison with the scale of estimates, the spread of values relative to the mathematical expectation will be too great. This can lead to a distortion of the estimate accuracy.

CONCLUSIONS
Based on the results of a previous comparative analysis of multi-criteria methods for choosing the suppliers, taking into account their advantages and disadvantages, we offered a modified method based on the "AHP" and "TOPSIS" methods. The advantage of the modified method is the maximum approximation of expert estimates to the reflection of the features of real-world objects in comparison with point expert estimates. This allows forming the most accurate initial data for further calculations.

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