***Multicriteria choice of pre-established businesses on the marketplace using the TOPSIS method***

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*Abstract.* The paper proposes an approach to the formation of recommendations for the selection of pre-established businesses in the marketplace using multicriteria choice methods. The TOPSIS method is used to make informed decisions among a set of alternatives. The system structure, stages and principles of business evaluation, data processing and modeling results are presented.

Keywords: Multiple decision making, multicriteria analysis, TOPSIS.

# Introduction

In the current economic environment, digital platforms have a significant impact on the process of buying and selling businesses. One of the most promising solutions is to create a marketplace that allows you to evaluate and compare pre-established businesses by a number of criteria. To do this, it is necessary to consider many factors (such as profitability, cost, risks, field of activity, etc.), which are associated with solving the problem of multicriteria choice. For this purpose, it is proposed to apply the TOPSIS multicriteria choice method, which provides a simple and clear interpretation of the results.

# Basic material

The developed system functions as an online platform that collects information about ready-made businesses and provides the user with a tool for comparing them. The structure includes a database of objects, a module for evaluating by criteria, normalizing data, calculating proximity to the ideal solution, and global weighting coefficients determined by the administrator.

Thus, it is necessary to select the best pre-established business from a set of alternatives based on the specified criteria. To solve this problem, it is proposed to use the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) [1].

The scheme of the method involves the following steps:

* normalization of the evaluation matrix;
* weighing the criteria;
* determination of utopian and dystopian solutions;
* calculating the distances of each alternative to these solutions.
* ranking the alternatives by proximity to the ideal.

# Problem statement

Suppose there is a set of pre-established businesses that are evaluated by entrepreneurs:

,

where - is a separate business that is evaluated by several criteria.

 Then, for each business, evaluation criteria are determined:

,

where each criterion characterizes a certain aspect of the business (financial performance, location, category, adaptation to conditions in Ukraine, etc.).

 The next step is to build a matrix of business evaluation criteria for each business:

,

where is the businessevaluation by criterion .

 Since different criteria are of different importance, we will introduce weighting factors:

, , ,

where eachcorresponds to the relative importance of the criterion.

 Based on the information about business valuations and the importance of the evaluation criteria, it is necessary to build a ranking on the set of businesses , which will allow the user to make the right decision about choosing the most profitable businesses for investment.

# Description of the solution method TOPSIS

Using the TOPSIS multicriteria choice method [1, 2] and such known data as set of pre-established businesses, business evaluation criteria , the matrix of business evaluations for each criterion and weighting coefficients , the first step is to normalize the evaluations of alternatives.

To do this, it is necessary to take into account that in the set of business evaluation criteria there are criteria that are subject to maximization – profit criteria , and there are criteria that are subject to minimization .

At the same time, regardless of the normalization procedure, the estimates of alternatives for all criteria will be in the interval [0, 100].

Then, for the profit criteria , the evaluation will be determined by the formula:

  (1)

where





 And for the cost criteria , the evaluation will be determined by the formula:

  (2)

 The next step is to calculate the weighted normalized scores of the alternatives:

  (3)

where is the weighed coefficient of the criterion ,

is the normalized scores determined by relations (1) – (2).

 Now we need to construct a positive ideal point PIS (utopian point) and a negative ideal point NIS (dystopian point):





 The next step is to calculate the distances of each alternative to the positive ideal point PIS and the negative ideal point NIS:





 Now to determine the closeness of each alternative to the positive ideal point of PIS (i.e., to determine the similarity to PIS):

,

where



 The last step is to organize the alternatives of in descending order of the value  of similarity to the positive ideal point of PIS. Then the best alternative is determined as follows:



 The ranking constructed in this way can be used in the recommendation component of an information system – a marketplace for buying and selling pre-established businesses – to support the decision-making process of users in choosing the best options.

##### Conclusion

 The paper proposes an approach to the multicriteria choice of a pre-established business on the marketplace using the TOPSIS method. The implementation of this approach into the system will allow users to rank business alternatives based on objective criteria and personalized weights, which will make the choice process more reasonable and personalized. The modeling results have shown the effectiveness of the approach to practical decision-making tasks, in the presence of a large number of options and conflicting criteria.

 It is recommended to implement the proposed approach in real marketplaces for automated business valuation, as well as to apply it in consulting platforms to support investors in choosing the best investment object.

##### References

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