

MULTICRITERIAL EVALUATION UNDER UNCERTAINTY ON THE BASE OF
THEORY OF FUZZY SETS AND LINGUISTIC VARIABLE

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The paper deals with the case when variants are known in advance and the acceptability of some criteria is characterized only verbally.

The definitions of the problems has been given. Evaluating terms (labels) has been selected and quantified for the purposes of the expert analysis. Particular variants has been characterized. The criteria for the variants' evaluation has been selected. The definition of the relations among the criteria has been given (by e.g. Saaty's method). The determination of the values of criteria for particular variants has been provided (verbally by expert estimates). On the basis of the data gained the computation and interpretation of the results has been worked out.

The lecture has been concentrated itself on the last two points of the problem examined.

Experts do evaluate the acceptability of the criteria for each variant by the evaluating term (label).

The average calculations of the experts' evaluation on the basis of the criteria weighting of each variant has been then provided. Thus the final membership function of the acceptability of particular variants are gained.

Several ways of interpretation of the results are being offered, e.g. the method of the computation of membership

function, the linguistic approximation, etc.

Newly proposed way of the results interpretation is rooted in the analysis of the deviation of the experts' statements. This interpretation seems to have a high referring ability and the immediate relations for the given task.

The interpretation of the results on the basis of the deviation of experts' statements respects the fact that the membership function of the acceptability for particular variants performs a basis, but not sufficient representation of their verbal evaluation.

The idea of this approach supposes that the level of uncertainty of the acceptability of the membership function for particular variants has in principle two facets:

- a) the fuzzy interpretation of verbal evaluation itself. The uncertainty of the evaluating terms (labels) is being characterized by the values of membership functions' acceptability. This uncertainty is being projected in the membership function of the acceptability of each variant. The different level of the evaluating terms' uncertainty applied by the variant evaluation is thus described by the fuzzy interpretation of the variant uncertainty;
- b) the level of the uncertainty is being given by the level of coincidence of experts as for the verbal evaluation of the membership functions in the framework of the particular criteria evaluation of each variant.

This leads to the conclusion that the membership function of the acceptability of particular variants has to be modified by the deviation of the experts' estimates.

This modified membership function is called interval

membership function, for the working purposes; the notion interval membership function is in the definition consonance with the notion ultrafuzzy sets which has been defined by prof. Zadeh in Chemtech '87.

The distinguishability, the undistinguishability respectively of two variants are being decided according to the magnitude of the shares of intersection and complements of ultrafuzzy sets of particular variants' acceptability (in approximative and discrete form on selected $\mu_A(x)$ values eventually).

The field for applications of this approach seems to be very wide. One of the efficient possibilities seems to be the application in decision-making among variants of the long-term planning. The approach described is suitable for the evaluation of different variants of capital investment actions, for the priority selection of particular branches on the makro-economic level, etc.

The main advantage of the procedures proposed is that they enable to include criteria so far neglected because of their unquantifiability.

This methods makes it possible to gain adequate results concerning not only ranking, but distinguishability of the variants from the uncertain informations.

In this paper some limits as for the approach presented for specific applications has been given.

Reference:

Zadeh L.A.: Yes, no, and relatively. Chemtech June 1987 (1), July 1987 (part 2), pp. 340-344, 406-410.