# CONTROL AND EFFICIENCY OF INNOVATION PROCESS _ APPLICATION OF NON TRADITIONAL MATHEMATICAL METHODS

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The complexity of the innovation process has been analyzed. The characteristics of the factors by traditional methods not quantifiable has been given. The significance of the fuzzy set theory and its methods for the utilization of practical control and efficiency estimation for particular innovation projects has been justified. The principles of modelling under uncertainty with the use of fuzzy sets theory for this special case have been outlined.

The explanation has been given how the practical computation procedures have been gradually on the basis of practical experiences simplified. One of the variants of the procedure, which is being at the present time applied for the efficiency of new types of asynchronous electric machines, was described in details. It is based on the following approach:

1. only supremum and infimum of the support of every evaluating term on corresponding reference set is to be given by the user;
2. the reference set can be characterized by the first and last element the lenght of interval and by the total number of elements;
3. the program (in FORTRAN) includes both phases i.e. the construction of the model and the computation of the result;
4. the model can be constructed as purely linquistic (operations on the set with binar membership function)

or fuzzy linquistic i.e. operating on fuzzy subsets. Moreover the program enables the construction of mixed numeric and verbal models;

5. in the program unified type of membership functions is considered; it is symetric doubleparametric.

The advantage of the unified formula of the membership function is evident-only the extreme values of the support of corresponding fuzzy subsets are required.

The program is constructed in the way that it includes information about the weight, significance and limitations of particular variables, particular evaluating terms respectively. Similarily the limitations of particular conditioned statements are built in the program.

Thus the user, in cooperation with the modelling and computing experts is supposed to offer information only about

a) the reference set (available extent) of particular variables of the model:
b) the evaluating scale of particular variables (the number of evaluating terms);
c) the boundries of the support of every evaluating term;
d) the set of conditional statements concerning the functioning of the model.

The case study concerns the innovation of new types of asynchronous electric machine. Thirty factors (variables) influencing the final effect of the innovation project have been included. The factors are devided into two basic groups

(i) factors of techno-economical character - mostly in quantitative form or in the form easily quantifiable

(ii) technological or economical factors of high uncertainty, hardly quantifiable e.g. factors representing internal and external conditions influencing the efficiency of innovation process, stimulae for creative activity, the relations with future producers, the adaptation ability for inventing ideas etc.

The evaluating terms are ranked in three level scale.

The output (effect) is characterized by the degree of financial evaluation of all imputs of the innovation project. (The evaluation of 1 Kčs of the expenditure spent on the innovation).

For the model construction 6 samples of conditional statements representing 6 variants of the functioning and utilization of given factors towards the effect are given.

In spite of limited sample of conditional statements the referring ability has been relatively high: According to particular variants the evaluation of the innovation process has represented 2,5 - 7 output effect ratio. In one case (variant) the output value was more then 7 times higher then the inputs.

It is evident that by using higher sample of evaluating terms the referring ability will adequately increase.

The application of the procedure was verified and is being verified in the prototype production of the Research Institute for Electrical Machines in Brno. The results reached so far are according to the user of high utility and the procedures are understandable for the people without specialized mathematical training. However it seems that the program could be further improved. It concerns especially the possibilities of broader comprehension of experts views as for the estimation of the membership functions and the selection of the evaluating terms scale (fuzzy subsets) concerning particular factors (variables).