# Innovation projects control and evaluation by means of modelling based on fuzzy technics.

---

Jiří Nekola, Institute of Chemical Process Fundamentals, Czechoslovak Academy of Sciences.

Practically all methods for innovation projects efficiency evaluation used so far are based on the comparation of the sum of expenditures spent for the project realization with the precalculation of real or preasumed effect within a defined time span.

The very generalized scheme of current praktice can be formulated as follows:

$$V_1 = V_o \left( \left( \sum_{i=1}^{k} a_i x_i - \sum_{i=1}^{m} b_j y_j \right) + a_o \right) \qquad (1)$$

$$V_2 = V_1 \left( \left( \sum_{i=1}^{p} e_p z_p - \sum_{i=1}^{q} d_q z_q \right) + d_o \right) \qquad (2)$$

$$E = k_e V_1 + k_e' V_2 \qquad (3)$$

where $V_o$ - input values in time $t_n$

$V_1$ - output values in time $t_{n+1}$ i.e. the evalution of basic expenditures in the process of research

and development activity

$a_i x_i$, $b_j y_j$ - the effect of particular variables (factors) influencing in positive or negative sence the creation of results in R+D activity for increase or decrease of total invention output.

$e_p z_p$, $d_q v_q$ - the effect of particular factors in the process of realization (utilization) of R+D activity results influencing the increase or decrease of the value $V_1$.

$V_2$ - output values representing the evaluation in the realization process

E - the overall outcome

$k_e$, $k_e'$ - total coefficients of efficiency or particular stages

$a_o$, $d_o$ - includ three dependent variable effects i.e.
- basic evaluation of $V_o$, $V_1$, $V_2$ for the case when evaluation of particular variables (factors) would be zero.
- the correction of the scale.
- the evaluation of residual factors i.e. of the part of final output caused by not quantifiable variables.

For the relation described generally in (1), (2), (3) different sets of equtations are used.

The main disadvatage of this traditional approach is rooted in the fact that it is possible to take in consideration only basicly quatified data corresponding to current

statistical surveys or other types of standard evidence.

Analyses worked out so far proved that more than 50% of factors influencing the efficiency of innovation process and of particular innovation projects is by standard methods and traditional procedures not quantifiable. When calculating the efficiency of innovation projects and the projects and activities of similar complex character as well, the influence of these factors has been omitted. The describtion ability in cosiderations of the final efficiency has been thus significantly limited.

The principle of modelling under uncertainty with the help of fuzzy technics and linguistic variable offers in this sence principally new approaches. The methodics of its practical application has been described in publications lit. 1,2,3 and briefly reffered in Busefal No 15, 1983 and No 20, 1984.

The experimental verification of the methods in industry namely in the Institute of Electric Machines, which unifies both R+D activity and industrial output has demonstrated surprisingly good results.

The computer program being mentioned i.a. in Busefal No 20,84 (Nekola, Zika) is being reformulated and coceptually corrected. Practical requirements namely from the point of simplicity, understandability and computer memory savings brought the necessity to combine the fuzzy and the deterministic approach in one program. Fuzzy technics is being applied namely as for input variables of the model; for the

output values, after different combinations of fuzzy technics, the deterministic approach is being used.

This conception of the program and proceeding steps is supposed to be reported on the IFSA Conference in Tokyo as experimental verifications in industry are planned untill May 1987.

At the present time it seems that the combination of fuzzy and determinist conception could be an efficient mean for broader application in other fields as well.

References:

Nekola J.: Research Report No 62/85, ICHPF, Cz. Academy of Sciences

Nekola J., Vrba J.: Research Report No 8/84, ICHPF, Cz.Ac. of Sciences

Nekola J., Zika M.: Proceedings of the National Symposium "Theory and Application of Fuzzy Sets II-III" p. 137-151, Praha 1985.