The own face of MCDM

Oleg I. Larichev

The interesting discussion in Opinion Makers Section of Newsletters of European Working Group "Multicriteria Aid for Decisions" posed the questions really important for MCDM community.

The most important ones are:

-Difference between Operations Research and MCDM;

-Theory and Practice in MCDM;

-How to teach MCDM.

I would like to propose my vision of the problems.

1. MCDM and OR.

In my opinion, the transfer from OR to MCDM does not connected with better representation of reality due to the fact that the reality is multicriterial. Not at all, this transfer relates with the change of a paradigm, with quite different approach to the analysis of problems.

There is the huge gap between two approaches.

The well known part of OR methodology is the construction of models representing the objective reality, small pieces of the world. The objective nature of model was stressed by Wagner [1] who noted that different experts working on the same problem must come to the same models. The justness of this requirement is quite understandable if we turn to the classic problems of operations research such as inventory control, transportation plans, queuing theory, etc.

Contrary to it, the most typical MCDM models reflect the personal DM's perception of the problem to be solved. DM himself defines the set of criteria and decision rules in the process of elaboration of a policy. This policy is always subjective. Everybody knows examples of dramatic changes of a country policy after the change of the President.

Such striking difference between two kinds of models is not so evident for the problems of "intermediate" nature. For example, in the method "cost-efficiency" we have two criteria, objective models of cost and efficiency and subjective decision rule of DM combining the two criteria.

2.Decision Maker as the central figure in MCDM

It is necessary to accept all consequences of the fact that human being is the central element in decision making processes. First of all ,it follows that the study of human information processing system has, at least, the same importance as the mathematical problems of decision making. Cognitive psychology, organisational behaviour belong to research disciplines of the same importance for decision making field as applied mathematics[2].

On the level of the existing knowledge it is possible to summarize the evidence about human behavior in the decision processes in the following way.

The features of the human information processing system important for the decision processes

A. Limited span of the working memory.

According to cognitive psychology , human being has a limited span of the short -term memory. In repeated tasks the span of the working memory could be enlarged but it takes both time and efforts.

That is why the DM could not simultaneously pay attention to many factors (or evaluations of alternatives upon criteria) in the new decision tasks. Really, for the new tasks, the DM has no possibility to create the internal structure of the necessary knowledge.

This limitation manifests itself in such known facts as: the DM is trying to simplify the description of the decision situation by replacing some of the criteria by limitations, by eliminating some of the criteria, by grouping the alternatives and so on . Such behavior is the unconscious desire to decrease the load on the short-term memory.

Experienced DM has usually the skill of simplifying the decision situation in the best possible way. For inexperienced DM a significant increase in the number of contradictions for more complex decision tasks is typical .

B. Limited exactness in quantitative measurements.

According to the existing knowledge, human being is not an exact measurement device producing quantitative measurements. The famous experiment of A.Tversky [3] demonstrated that people neglect small differences in the evaluations. It is the reason for the intransitive behavior in some problems of choice. Inability to take into account small differences in the evaluation leads to the elimination of the dominating alternatives by the conservation of the dominated ones [4].

The experiments demonstrated that people can poorly measure the probabilities in the quantitative way (see above). The change in the method of measurement, the transfer from the quantitative to the verbal probability allows one to decrease significantly the number of the preference reversals.

C. Human errors and contradictions.

It has been known since the time of antiquity that "To err is human". People err when processing information. There could be different reasons for a such behavior: weariness, lack of attention, habitual heuristics and so on.

The features of human behavior in the decision processes

A. Absence of preconceived decision rules in new decision tasks.

As many researchers supposed, the DM has no preconceived decision rules. As noted in [5], it can be hardly expected that the utilities and numbers expressing the subjective estimates of the objects and situations are just stored in our minds until elicited. According to B.Roy constructive approach [6], the decision methods are tools that could be used by DM to gradual development of the policy. To develop a decision rule the DM needs time and some learning procedures. Usually people use some kind of a "trial and error " approach in such procedures.

B. Search of the dominance structure.

At every step of the decision making procedures people pay attention to the limited number of objects. This is a possible explanation to the psychological theory of human behavior in the decision tasks-the search of the dominance structure [7]. According to the theory, in the case of the limited number of alternatives people make a preliminary selection of the potentially best alternative and compare it pair-wise with other alternatives , trying to check the fact of dominance.

In the case of a bigger number of alternatives, people use initially the strategy of eliminating by aspects and after that utilize a more elaborated process (like the search of dominance) for a smaller number of alternatives.

C. Minimization of human efforts.

J. Payne suggested and substantiated another theory of human behavior upon choosing the best multicriteria alternative(s) that can be called the theory of the constructive processes.

When comparing multicriteria alternatives, people can use various strategies. The studies of J. Payne [8] have demonstrated that in the process of the decision making the subjects often choose a strategy depending on the specific features of the alternatives under consideration (their evaluations by criteria). Here, the human preferences of the alternatives and criteria are very unstable. At the local stages of the comparison, rules (or their parts) can vary depending on the relation between the required human effort and the accuracy of choice.

As J. Payne notes, such a behavior is a characteristic of the untrained subjects. People experienced in the decision making, as well as regular decision makers have their preferable strategies for solving problems.

The features of human behavior in organizations

A. Satisfactory decisions.

The studies of economists and psychologists provided an insight into the human decision making in large organizations.

H.Simon [9] introduced the notion of the satisfactory decisions as a counter to the optimal ones. In organizations, the life itself brings people to seek satisfactory decisions - the environment is too complicated to be described by a model, the multiple criteria are defined incompletely, there are many active groups influencing the choice, etc. This natural behavior of the personnel resulted in the loss of the strategic objectives amid the petty, everyday routine.

B. Taking the power in the hands.

The desire to have the decision situation under control is typical for the behavior of the DM in organizations. It means that the DM is trying to control all stages of the decision making, all transformations of the information influencing a decision.

Speaking differently, the DM is trying to have the power in the hands. In the case when it is necessary for him/her to take into account the interests of different active groups, the DM is looking for a mutually satisfying decision, but he/she is always trying to put into the life the principal components of own policy.

I would like to stress here again that MCDM is multidisciplinary field of research (I agree in this aspect with Anna Ostanello). It is very important to understand it while discussing the roles of theory and practice in MCDM.

3.Theory and practice in MCDM.

The dispute about the roles of theory and practice in MCDM (newsletter 9) is constrained by the view of theory as applied mathematics.

But why only applied mathematics? Why not cognitive psychology or organisational behaviour ?

I would like to propose the answer to such questions. Essentially MCDM is applied science. The main goal of research in MCDM is to develop tools helping people to make more reasonable decisions (I agree in this aspect with J.Pictet, V.Belton and A.Ostanello).

But sometimes the development of such tools is connected with the problems in applied mathematics, cognitive psychology, organizational behaviour . The solution of the problems could be provided by researchers from corresponding research fields having no connections (or weak connections) with real problems of decision making (I agree in this aspect with D.Bouyssou et all publication in newsletter 9). Of course, the quality of such theoretic research must be evaluated by the criteria of corresponding research disciplines.

Due to the fact that MCDM is applied field, the important role in this field plays practitioners. They must provide the syntheses of the results received in different disciplines, only they could find new theoretical statements of problems. The quality of their practical work depends strongly from interdisciplinary knowledge as well as from personal skill of consultant.

I would like to propose here the parallel with medicine. We all know that good physician has big practical experience and he/she is the most important person helping people .But there are specialists developing tools for surgeons, developing medicines and so on.

4.How to teach MCDM.

If one looks at MCDM as the branch of applied mathematics, it could find the place in general course of OR.

But if MCDM is multidisciplinary field, the teaching of it must be quite different. Together with utility theory, multiattribute utility theory, prospect theory the knowledge about human memory, organization of human information processing system, human behaviour in organisations must be given. Just such course of lectures could give right image of MCDM, could show to students real face of MCDM.

References

1.Wagner H.M.,(1969) .Principles of Operations Research,Prentice-Hall,Inc.,Englewood Cliffs,New Jersey.

2.Larichev O.I., Moshkovich H.M. (1997). Verbal Decision Analysis for Unstructured Problems ,Kluwer Academic Publishers,Boston.

3.Tversky A., Intransitivity of Preferences, Psychological Review, 76, pp. 31-48, 1969.

4.Korhonen P., Larichev O., Moshkovich H., Mechitov A., Wallenius J. Choice behavior in a Computer-Aided Multiattribute Decision Task, Journal of Multi-Criteria Decision Analysis, v.6, 1997, pp. 233-246.

5.von Winterfeldt D., Edwards W., Decision Analysis and Behavioral Research, Cambridge University Press, 1986.

6.Roy B. Multicriteria Methodology for Decision Aiding, Kluwer Academic Pulisher, Dordrecht,1996.

7.Montgomery H., Svenson O., A think-aloud study of dominance structuring in decision processes, In: H. Montgomery, O. Svenson (Eds.), Process and Structure on Human Decision Making, J. Wiley and Sons, Chichester, pp. 135-150, 1989.

8.Payne J. W., Bettman J. R., Coupey E., Johnson E. J., A constructive process view of decision making :multiple strategies in judgment and choice, In: O. Huber, J. Mumpower, J van der Pligt, P. Koele (Eds.), Current Themes in Psycological Decision Research, North Holland, Amsterdam, pp. 107-142, 1993.

9.Simon H.A., The New Science of Management Decision, Harper and Row Publ., 1960.