MULTIPLE CRITERIA DECISION SUPPORT:

Theory, Applications and Computer Implementation

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HOW IT ALL STARTED

In 1978 Korhonen and Wallenius undertook a project on multiple criteria/multiple person decision making at the Vaasa Business School, Finland. There were several reasons for beginning such a project. The field was rapidly growing and posed great research challenges -both theoretical and applied. Over the years, Korhonen and Wallenius have worked closely on problems of multiple criteria decision making, decision support, computer implementations of such systems, theory and applications of negotiation models, and so forth - despite the fact that they have worked in different universities, sometimes in different countries. The work has involved several other persons as well, both in Finland and abroad, and it has evolved into a truly international, inter-disciplinary effort. Since we are now both working at the Helsinki School of Economics, it has been natural to expand our effort into a major research project. ŇMultiple Criteria Decision SupportÓ (MCDS) is a generic title for several research projects focusing on decision making with multiple criteria.

WHAT WE ARE Trying TO Achieve

The purpose of our research is - to develop new approaches to solving various multiple criteria problems, - to explain human choice behaviour, - to seek new ways to utilise computer technology in supporting decision making - to develop new computer systems for supporting the modelling and solving of multiple criteria problems, and - to apply novel approaches developed within the framework of the project to practical problems in the public and private sector.

WHO ARE INVOLVED?

Our research group is like an umbrella under which many topics are researched by individuals from different departments - even different universities. Several of the post graduate and MBA-students are Management Science majors, who often work also under the guidance of Professor Markku Kallio1. - 2 professors (P. Korhonen, J. Wallenius) - 5 researchers (Dr. M. Halme, Dr. M. Kuula, Dr. M. Soismaa, and Dr. H. Wallenius, Helsinki School of Economics (HSE); Dr. P. Salminen, University of Jyvaskyla) - 7 post-graduate students (K. Aalto, I. Haapalinna2, J. Pajunen2, T. Sappala, A. Siljamaki, L. Tanner2 and G.-Y. Yu) at HSE - 7 MBA students (T. Joro, E. Koskinen, A. Komonen, R Salmenkyla, S. Toivonen, A. Varpenius, A. Oorni) at HSE - 4 domestic collaborators (Prof. M. Kallio, Assoc. Prof. H. Kivijarvi, Prof. E. Kasanen, Prof. S. Salo, IISE; Prof. J. Ranta, VTT) - 21 foreign collaborators (Prof. A. Arbel, Dr. A. Atanassov, Dr. A. Davey, Prof. L. Duckstein, Dr. J. Karaivanova, Prof. O. Larichev, Dr. A. Mechitov, Dr. H. Moshkovich, Prof. H. Moskowitz, Prof. S. C. Narula, Pror. D. Olson, Prof. N. Oretskin, Prof. A. Roy, Prof. A. Stam, Prof. J. Spronk, Prof. R. Steuer, Prof. A. Tecle, Prof. J. Teich, Prof. V. Vassilev, Prof. W. Michalowski, Prof. S. Zionts)

WHAT WE ARE CURRENTLY WORKING ON

- A verbal think-aloud protocol analysis of human decision processes: A case study of selecting applicants for a Ph.D. program (Davey, Olson, J. Wallenius) - The impact of a biased starting position in a single negotiation text type mediation: An experimental study (Korhonen, Oretskin, Teich, J. Wallenius) - Identifying pareto-optimal settlements for two-party resource allocation negotiations (Teich, H. & J. Wallenius, Zionts) - Decision making practice vs. MCDM paradigm: insights from case studies (Kasanen, H. & J. Wallenius) - Multiple criteria portfolio selection: Theory and MCDSS (Korhonen, Yu) - Identifying efficient trade-offs in multiple objective linear programming (Halme Kallio, Korhonen) - Multiple criteria decision aid for the strategic management of flexible manufacturing (Kuula, Ranta, Starn) - Large-Scale multiple objective linear programming under

uncertainty (Tanner) - Mock Pseudo-Negotiations With Surrogate Disputants. Case: Energy Taxation in Finland (Pajunen) - Multiple objective integer linear programming (Karaivanova, Korhonen, Narula, Wallenius, Vassilev) - Estimating nadir criterion values in multiple objective linear programming (Korhonen, Salo, Steuer) - How to avoid weakly non dominated solutions in multiple objective linear programming: Lexicographic parametric programming approach (Halme, Korhonen) - Generating interior search directions in multiple objective linear programming using aspiration levels (Arbel, Korhonen) - Interactive and visual fuzzy multicriterion modelling applied to watershed management (Duckstein, Korhonen, Tecle) - How to process criteria in discrete choice problem - parallelly vs. sequentially: An experimental comparison? (Korhonen, Larichev, Mechitov, Moshkovich, J. Wallenius) - A visual interactive multiple criteria decision support system for discrete alternatives with numerical criteria (Karaivanova, Korhonen)

NEW IDEAS?

The importance of criteria It seems very natural for a human being to say that criterion A is more important than criterion B. What is the meaning of this statement? The purpose is to find workable explanations (models) for this problem, and test them in laboratory experiments. (Korhonen, J. Wallenius). Impact of starting point on the final outcome The impact of the starting point on the final outcome in a multiple criteria decision task is systematically (experimentally) studied. Preliminary results seem to indicate that the starting point plays a significant role. (Korhonen, Michalowski, J. Wallenius) Progressive group decision making We study the Ňmarriage problemÓ in a group decision context, where the entire set of decision alternatives is not initially known. The group may consider the option of progressively augmenting the sample of alternatives. (Salminen, Teich, J. Wallenius)

ACTIVITIES

- International, interdisciplinary research - Joint research with graduate students - Weekly post-graduate research seminar - Organising annually an intensive (two-day) post-graduate research seminar with internationally recognised keynote speakers - Bi-weekly MBA research seminar - Regular visits by members of our research group to foreign universities - Co-ordinating the visits of foreign graduate students and young scientists to the Helsinki School of Economics to conduct joint work with our graduate students and faculty - Organising clusters and sessions in international conferences on MCDS; giving lectures & tutorials on MCDS in international conferences, seminars. summer schools - Lectures in management development programs in Finland

WHAT HAS BEEN ACHIEVED

- New theory and approaches to solving linear, non-linear, and discrete multiple criteria decision problems - An approach to solving multiple objective linear programming problems with qualitative data - Various approaches to supporting group decision making - New theory for Human choice behaviour - Two also commercially available multiple criteria decision support systems (VIG and VlMDA) - Six prototypes of multiple criteria decision support systems: PORFO: Portfolio Selection PROGA: Progressive Algorithm RAMONA: Resource Allocation Model for Negotiation REMON: Reduced Gradient Algorithm for Non-linear Multiple Criteria Optimisation SPCA: Subjective Principal Component Analysis VICO: Visual Multiple Criteria Comparison - Several real life applications - 81 conference presentations between 1985 - 1992 - By 1992, 1000 citations were recorded excluding within group cross-citations.

A Theses B Articles in Refereed Journals (1975 -) C Contributions to Books and Conference Proceedings (1976 -) D Unpublished Discussion and Working Papers (1990 -) E Lecture Notes and Articles in Professional Magazines (1987 -) F Edited Volumes (1986 -)

1 Collaborators are colleagues who are our co-authors in one or more joint articles, but who do not actually work in the group. 2 Also working under guidance of Professor Markku Kallio.