

MCDA ACTIVITIES OF THE IST-CESUR/CISED GROUP (1995-)

(co-ordinated by Carlos A. Bana e Costa)

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1. CONTEXT

The lecturing, research, and professional consulting "MCDA activities" of the group of people co-ordinated by the author of this article have been under development at:

-The Engineering Institute (IST) of the Technical University of Lisbon, lecturing the courses "Project evaluation and public decision-making" and "Multicriteria decision aid models" (65 hours each one) attended by students of the last year of Engineering (Civil, Territorial, Environment, and Industrial) and "Decision Aid" (30 hours) of the Masters in Operational Research and Urban and Regional Planning;

-CESUR (the Centre of Urban and Regional Systems of IST) and recently the UEGI (the IST Research Unit on Economics and Industrial Management).

-CISED Consultores, Lda. a small consulting company with a permanent technical staff of 10 people, owned by a few IST colleagues and myself.

2. ON-GOING AND MOST RECENT MCDA RESEARCH PROJECTS (SEE ALSO REFERENCES IN §5)

-MACBETH, Measuring Attractiveness by a Categorical Based Evaluation Technique developed by Carlos A. Bana e Costa and Jean-Claude Vansnick (University of Mons-Hainaut, F.W.S.E); partially financed by the Cultural Exchange Program between Portugal and Belgium.

MACBETH is an approach designed for building a cardinal numerical scale measuring the attractiveness of the elements of a set X, throughout a learning process supported by a visual interactive software (see § 4). Traditional approaches for cardinal value measurement require the decision-maker to answer very difficult judgmental questions and do not offer any practical way for the verification of the reliability of the obtained preference information. The challenge to overcoming these weaknesses by developing a new constructive approach, at the same time theoretically well founded and practically operational, was the main motivation to the research that led to this new approach. MACBETH involves only two stimuli in each question; tests the consistency of the answers; offers suggestions to bypass inconsistent situations; provides the analyst with the means adequate for aiding the decision-maker to enter into the domain of cardinal measurement. ([14] to [19]).

-Integrating MCDA with Problem Structuring Methods partially developed in collaboration with the research team of Leonardo Ensslin at UFSC (Federal University of Santa Catarina, Brazil) [2] to [7].

-Links between MCDA and Rough Sets [10].

-DTCS, Spatial decision support for negotiation and conflict resolution of environmental and economic effects of transport policies developed in collaboration with the Institute for Environmental Studies (IVM - Free University of Amsterdam), the Centre for European, Regional and Transport Economics (CERTe University of Kent), and the Consorzio Universitario in Ingegneria per la Gestione di Impresa (MIP Politecnico di Milano) financed by the European Commission, DG12-Unit D5 (Program Environment and Climate). Web site: www.vu.nl:8000/ivm/dtcs/dtcs.htm. [22].

-MCDA applied to TQM: Construction of a total quality index for an organisation according to the EFQM model (European Foundation for Quality Management) developed in collaboration with the Lisbon Gas Company (GDL) financed under the PRAXIS XXI Program.

-MCDA applied to the evaluation of Municipal Master Plans financed by JNICT/DGOTDU.

3. ON-GOING AND MOST RECENT MCDA REAL-WORLD APPLICATIONS AND CONSULTING PROJECTS (see also references in §5)

- Siting the new Lisbon airport.
- Multi-criteria / multi-scenarios analysis of a new railway link through the Central Pyrenees.
- Multicriteria support to the design of a new railway link to the port of Lisbon [11].
- A model to establish priorities for intervention in repairing Portuguese monuments.
- Evaluation of inter-municipal projects to improve the quality of the Lisbon Region road network [22].
- Policy analysis and resource allocation to Oporto development projects in the period 1998-2001.
- MCDA based development of a Strategic Plan for the city of Barcelos [2] and [3].
- Multicriteria environmental impact evaluation of flood control measures at Ribeira do Livramento basin.
- Multicriteria decision support in evaluating proposals to international public calls for tenders and contractors' choice, namely to the expansion of the Lisbon subway network, the construction and operation of the Metro system at Oporto, the construction of a new energy facility, the construction of the natural gas network of Lisbon, the construction of several water supply systems in Portugal, etc. [9]
- A model for performance evaluation of top managers of the Portuguese Gas Company.
- Decision Support Systems for on-going evaluation of Lisbon Gas Company's service and material suppliers.
- Evaluation of the competitive capacity of Santa Catarina small and medium sized textile firms [6] and [7].
- Choosing a rice variety for seeding at São Francisco farm at the South of Brazil [4].
- Ranking expansion options of TELESC cellular telephony system [5].
- A multicriteria model for the evaluation of measures of EC structural programs developed in collaboration with Philippe Vincke (Free University of Brussels) [17] and [24].

4. MCDA SOFTWARE DEVELOPMENT

-The MACBETH DSS, developed in collaboration with Jean-Claude Vansnick and Jean-Marie De Corte of the University of Mons-Hainaut, F.W.S.E.

The user friendly and visual interactive MACBETH decision support software has already proved to be useful for decision-aid in many public and private decision-making contexts in which the MACBETH approach was applied for building cardinal value functions and assessing the scaling constants of additive value models - see examples in [6], [9], [15], [17], [21] and [24].

--PROBE (Preference Robustness Evaluation)

PROBE is a multicriteria decision support system designed to deal with evaluation problems under conditions of ordinal information available about the scaling constants of an additive (hierarchical) aggregation model. PROBE computes the interval of variation of the overall value of each alternative and the interval of variation of the difference between the overall values of each two alternatives, at

each branch of a value tree. Based on this information the so-called cases of "additive dominance" (the ordered pairs of alternatives x and y such that the overall value of x is always greater than the overall value of y for a previous defined ranking of the weights) can be found.

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