Optimising Transport Decision Making using Customised Decision Models and Decision Conferences - DTU Orbit (09/12/2018)

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The subject of this Ph.D. thesis entitled “Optimising Transport Decision Making using Customised Decision Models and Decision Conferences” is multi-criteria decision analysis (MCDA) and decision support in the context of transport infrastructure assessments. Despite the fact that large amounts of money are spent on examinations of transport infrastructure projects, such as traffic model calculations, environmental impact assessments (EIA), and public hearings, the results mainly express the outcome of the examinations in monetary terms in form of e.g. a benefit-cost rate (B/C-rate). This thesis is concerned with the insufficiency of conventional cost-benefit analysis (CBA), and proposes the use of MCDA as a supplementing tool in order to also capture impacts of a more strategic character in the appraisals and hence make more use of the often large efforts put in the preliminary examinations.

MCDA depends to a high degree on subjective preferences stated by the decision-makers as the methodology deals with impacts (or criteria) that are difficult to quantify or assign with a monetary value. As a result of this an examination process is proposed that can guide the decision-makers through the difficult task of assessing the impacts. Important for this process is that it should be based on appropriate methods and techniques, which are capable of modelling the decision-makers’ preferences and well as communicating the results.

The main focus of this Ph.D. study has been to develop a process and framework for providing valid, flexible and effective decision support in situations where complex decision problems concerning transport infrastructure projects are to be assessed. Throughout the study five papers have been produced laying the foundation with different case examples ranging from road and rail to bike transport projects. Two major concerns have been to propose an examination process that can be used in situations where complex decision problems need to be addressed by experts as well as non-experts in decision making, and to identify appropriate assessment techniques to be used in the decision process.

The first contribution of this Ph.D. study is a framework of MCDA techniques to be used in decision processes. Depending on which type of persons that is to be involved in the decision process different assessment techniques are proposed. Two main modes are in this respect relevant: a basic-user mode consisting of non-experts, and an expert-user mode consisting of professional and experienced users of the techniques. The second contribution of the study is an examination process that proposes how the appraisal of infrastructure projects can be designed from the initial problem identification to the possible decision making. The process makes use of a preliminary problem structuring phase, and an intervention phase featuring the concept of a decision conference where decision-makers and multiple stakeholders have the possibility of interacting with the decision support model and thereby also influencing the results.

Based on the methodology and process developments throughout the thesis the following four main findings are presented:

1. The composite model for assessment (COSIMA) is an effective decision support system (DSS) for complex planning problems involving both monetary impacts and non-monetary criteria.
2. Direct rating using pair wise comparisons is found to be an appropriate MCDA approach for computing scores for alternatives while rank based approaches are appropriate for eliciting criteria weights from the decision-makers’ preferences.
3. Decision analysis and decision conferences using MCDA are useful approaches for structuring and appraising large and complex decision problems with participation of relevant stakeholders and decision-makers.
4. The REMBRANDT technique with its better theoretical foundation can with a modified progression factor be recommended for practical use instead of the original AHP to derive decision-maker preferences.

In summing up, this Ph.D. thesis provides a broad foundation for further exploration and application of a MCDA based decision support framework. It is concluded based on the findings that MCDA ought to have a more widespread use in transport planning as several types of appraisal problems can be approached in an adequate way by making use of MCDA, where process and methodology is customised (optimised) in accordance with the actual case dealt with. A number of perspectives and future research possibilities are outlined related to both the applications of MCDA techniques and the decision process.

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