Preface

Multiple criteria decision making is a field researched vastly and deeply over the last 40 years. As the result, a multitude of approaches and methods have been proposed, and those are well represented in books and journal papers. A researcher in this field, actual or perspective, has many choices.

On the other hand, any other person, in want to start quickly with decision making in a multiple criteria context, would face a serious problem. Where should one find a set of notions and prescriptions, simple but comprehensive—a *toolbox*? A *universal toolbox*, domain and application unspecific?

This textbook comes to such persons in assistance.

The messages we convey in the text are as follows:

– Multiple criteria decision making is a right framework to handle decision making problems whenever more than one criterion comes into play.

– Multiple criteria decision making offers a toolbox, meant as above, to handle such problems, and this toolbox sets a relatively low cognitive barrier for its potential users.

However, there are prerequisites for an easy reading of the textbook and the effective use of the toolbox. It is assumed that the

reader is already acquainted with the notions of *optimal value* (*maximal value*, *minimal value*) of *function* under *constraints* on *arguments* of that function.

An *optimization model*, i.e., the set of three elements,
– a *criterion function*,
– a *maximization operator* or *minimization operator*,
– a *set of constraints* on *arguments* of the criterion function,
is a formal framework for modeling many economic, technical, and social phenomena, taking the form of *decision making problems*. By filling data into an optimization model, we get an optimization problem. The values of arguments which yield the optimal value of the criterion function, i.e., the *optimal solution* to the optimization problem, represent the *most preferred decision variant*. Considerations of that sort are the subject of *operations research*.

Optimization models are too often oversimplifications of decision problems met in practice. For instance, modeling company performance by an optimization model, in which the criterion function is short-term profit to be maximized, does not fully reflect the essence of business management. The company managing staff is accountable not only for operational decisions but also for actions which shall result in the company's ability to generate a decent profit in the future. This calls for management decisions and actions which ensure short-term profitability but also maintaining long-term relations with clients, introducing innovative products, financing long-term investments, etc. Each of those indispensable actions and effects they produce can be modeled separately, case by case, by an optimization model with a criterion function adequately selected. However, in each case, *the same* set of constraints represents the range of company admissible actions. The aim and the scope of this textbook is to present methodologies and methods enabling modeling of such actions *jointly*.

This textbook is primarily intended for students of a PhD program in a field related to management science, operational research, or industrial mathematics, but it can also serve as a base for a graduate course. However, for a PhD program it is recommended to add some illustrative examples and/or problems from the specific students' domain.

The textbook is self-contained; to follow it the reader does not need to refer to additional sources. However, the references given at the end can be a starting point for further research into methodologies and applications of decision making in the *multiple criteria setting.*

Acknowledgments

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