

Model-Based Decision Support Methodology with Environmental Applications

The complexity of issues requiring rational decision making grows and thus such decisions are becoming more and more difficult, despite advances in methodology and tools for decision support and in other areas of research. Globalization, interlinks between environmental, industrial, social and political issues, and rapid speed of change all contribute to the increase of this complexity. Specialized knowledge about decision-making processes and their support is increasing, but a large spectrum of approaches presented in the literature is typically illustrated only by simple examples. Moreover, the integration of model-based decision support methodologies and tools with specialized model-based knowledge developed for handling real problems in environmental, engineering, industrial, economical, social and political activities is often not satisfactory. Therefore, there is a need to present the state of art of methodology and tools for development of model-based decision support systems, and illustrate this state by applications to various complex real-world decision problems.

The monograph reports many years of experience of many researchers, who have not only contributed to the developments in operations research but also succeeded to integrate knowledge and craft of various disciplines into several modern decision support systems which have been applied to actual complex decision-making processes in various fields of policy making. The experience presented in this book will be of value to researchers and practitioners in various fields. The issues discussed in this book gain in importance with the development of the new era of the information society, where information, knowledge, and ways of processing them become a decisive part of human activities. The examples presented in this book illustrate how various methods and tools of model-based decision support can actually be used for helping modern decision makers that face complex problems.

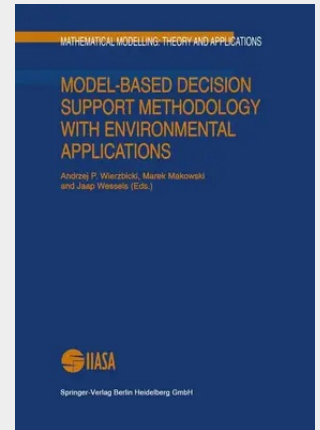
Overview of the contents: The first part of this three-part book presents the methodological background and characteristics of modern decision-making environment, and the value of model-based decision support thus addressing current challenges of decision support. It also provides the methodology of building and analyzing mathematical models that represent underlying physical and economic processes, and that are useful for modern decision makers at various stages of decision making. These methods support not only the analysis of Pareto-efficient solutions that correspond best to decision maker preferences but also allow the use of other modeling concepts like soft constraints, soft simulation, or inverse simulation.

The second part describes various types of tools that are used for the development of decision support systems. These include tools for modeling, simulation, optimization, tools supporting choice and user interfaces. The described tools are both standard, commercially available, and nonstandard, public domain or shareware software, which are robust enough to be used also for complex applications.

All four environmental applications (regional water quality management, land use planning, cost-effective policies aimed at improving the European air quality, energy planning with environmental implications) presented in the third part of the book rely on many years of cooperation between the authors of the book with several IIASA's projects, and with many researchers from the wide IIASA network of collaborating institutions. All these applications are characterized by an intensive use of model-based decision support.

Finally, the appendix contains a short description of some of the tools described in the book that are available from IIASA, free of charge, for research and educational purposes.

The experiences reported in this book indicate that the development of DSSs for strategic environmental decision making should be a joint effort involving experts in the subject area, modelers, and decision support experts. For the other experiences discussed in this book, the authors stress the importance of good data bases, and good libraries of tools. One of the most important requirements is a modular structure of a DSS



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