

Integrated Series in Information Systems 37

Series Editors: Ramesh Sharda · Stefan Voß



Jason Papathanasiou

Nikolaos Ploskas

Isabelle Linden *Editors*

# Real-World Decision Support Systems

Case Studies

 Springer

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# **Integrated Series in Information Systems**

Volume 37

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*To the Euro Working Group on Decision  
Support Systems coordination board and  
members, for their continuous and inspiring  
commitment on the promotion of the  
discipline*

# Foreword

Decision support systems (DSSs) appeared in the literature by the beginning of the 1970s. The first developed DSS was developed for executive managers using personal computers and was called executive information systems. Since this period, DSS evolved in several directions. The first proposed architecture of these systems was composed by a database management system, a model base management system, and a man-machine interaction module. The first step in the evolution of DSS was based on the introduction of knowledge in the architecture. A new module was added called the knowledge-based management system as well as an inference engine. From then on, due to a huge amount of data, the database management system evolved in line with research on data warehouses, for which the main concern is to find suitable data for the decision-maker. For the model base management system, a lot of research has been conducted including several kinds of models of real decision problems. These models are formulated in different ways like linear or constraint programming, decision rules, decision trees, etc. Nowadays, researchers on DSS are still very active and dynamic, and we can notice an evolution of the name; DSSs are also called in a more general way decision-making support systems (DMSSs). The number of international journals and international conferences on this topic is progressing every day. Recently, a new such journal, the *International Journal of Decision Support System Technologies* was created, published by IGI Global. This journal publishes selected papers organized in one volume per year including four issues composed of four papers. We can also mention the International Conference on Decision Support System Technologies organized annually by the Euro Working Group on Decision Support Systems. The conference attracts every year an international group of researchers, academics, and practitioners working on decision support systems. Topics covered by both the journal and the conference are, among others, context awareness, modeling, and management for DMSS; data capture, storage, and retrieval; DMSS feedback control mechanisms; function integration strategies and mechanisms; DMSS network strategies and mechanisms; DMSS software algorithms; DMSS system and user dialog methods; system design, development, testing, and implementation;

DMSS technology evaluation; and finally DMSS technology organization and management.

Nevertheless, this research would be without any actual interest if applications would not be developed and tested in real-life situations. The applications of DSS or cases of DSS are also very important and allow researchers to implement their architectures, models, and methodologies in real situations. These implementations are very valuable for the improvement of the DSS field. Indeed, the idea of this book, *Real-World Decision Support Systems – Case Studies*, including the application domains of the environment, agriculture and forestry, business and finance, engineering, food industry, health, production and supply chain management, and urban planning, is an excellent initiative. Research on the DSS discipline is still very promising and will be exciting for several decades to come.

Toulouse, France  
June 2016

Pascale Zaraté



# Preface

The number of papers regarding decision support systems (DSSs) has soared during the recent years, especially with the advent of new technologies. Indeed, if someone considers DSS as an umbrella term [1], the plurality of research areas covered is striking: from computer science and artificial intelligence to mathematics and psychology [3]. It is in this context that the editors of this book felt that there is a gap in the overall fabric; it was felt that too much attention has been given to theoretical aspects and individual module design and development. In addition, there have been many failures in information systems development; poor initial requirements analysis and design has many times led to a notable lack of success. Indeed, it seems that the DSS discipline is rather prone to this, tagging the development of such projects as risky affairs [2].

Moreover, decisions today have to be made in a very complex, dynamic, and highly unpredictable international environment with various stakeholders, each with his own separate and sometimes hidden agenda. Right into the center of the whole decision process is the decision-maker; he has the responsibility for the final decision and he will most probably bear the consequences. As there is no model that can integrate all the possible variables that influence the final outcome and the DSS results have to be combined with the decision-maker's insights, background, and experience, the system must facilitate the process at each stage rendering the user experience concept of great significance.

Bearing the above in mind, the rationale behind this edition is to provide the reader with a set of cases of real-world DSS, as the book title suggests. The editors were interested in real applications that have been running for some time and as such tested in actual situations. And not only that; unsuccessful cases were targeted as well, systems that at some point of their life cycle were deemed as failures for one reason or another. If the systems failed, what were the (both implicit and explicit) reasons for that? How can they be recorded and avoided again? The lessons learned in both successful and unsuccessful cases are considered invaluable, especially if one considers the investment size of such projects [4]. The overall and primary goal in each case is to point out the best practices in each stage of the system life cycle, from the initial requirements analysis and design phases to the final stages of

the project. The cases aim to stimulate the decision-makers and provide firsthand experiences, recommendations, and lessons learned so that failures can be avoided and successes can be repeated.

The authors of the chapters of this book were requested to provide information on a number of issues. They were asked to follow a certain chapter structure, and their work was rigorously peer-reviewed by the editors and selected reviewers from the DSS community. The cases are also presented in a constructive, coherent, and deductive manner, in order to act as showcases for instructive purposes, especially considering their high complexity. This book consists of one introductory chapter presenting the main concepts of a decision support system and 12 chapters that present real-world decision support systems from several domains. The first chapter by Daniel Power reviews frameworks for classifying and categorizing decision support systems, while it also addresses the need and usefulness of decision support system case studies.

Chapter 2 by Malik Al Qassas, Daniela Fogli, Massimiliano Giacomini, and Giovanni Guida presents the design, development, and experimentation of a knowledge-driven decision support system, which supports decision-making processes that occur during clinical discussions.

Chapter 3 by Anna Arigliano, Pierpaolo Caricato, Antonio Grieco, and Emanuela Guerriero proposes a method to integrate decision analysis techniques in high-throughput clinical analyzers. The proposed method is integrated into a clinical laboratory information system in order to demonstrate the benefits that it achieves.

Chapter 4 by Andrea Bettinelli, Angelo Gordini, Alessandra Laghi, Tiziano Parriani, Matteo Pozzi, and Daniele Vigo is about a suite of two decision support systems for tackling network design problems and energy-production management problems.

Chapter 5 by Pierpaolo Caricato, Doriana Gianfreda, and Antonio Grieco analyzes a model-driven decision support system to solve a variant of the cutting stock problem on a company that produces high-tech fabrics.

Chapter 6 by Mats Danielson, Love Ekenberg, Mattias Göthe, and Aron Larsson introduces a procurement decision support system implementing algorithms targeted for decision evaluation with imprecise data that it can be used as an instrument for a more meaningful procurement process.

Chapter 7 by António J. Falcão, Rita A. Ribeiro, Javad Jassbi, Samantha Lavender, Enguerran Boissier, and Fabrice Brito presents a model-driven evaluation support system for open competitions within Earth observation topics.

Chapter 8 by Narain Gupta and Goutam Dutta presents the design, development, and implementation of a model-based decision support system for strategic planning in process industries.

Chapter 9 by Andreja Jonoski and Abdulkarim H. Seid explains the experiences in developing and applying a model-driven decision support system in a trans-boundary river basin context, taking the Nile Basin decision support system as a case.

Chapter 10 by Manfred J. Lexer and Harald Vacik presents a data-driven decision support system for forest management that can support all phases of the decision-making process.

Chapters 11 and 12 by Mário Simões-Marques examine in detail a decision support system for emergency management. Chapter 11 describes the problem context, the system requirements and architecture, the knowledge management process, and the spiral development approach, while Chap. 12 presents the main features implemented in the proposed decision support system.

Finally, Chap. 13 by Mette Sønderskov, Per Rydahl, Ole M. Bøjer, Jens Erik Jensen, and Per Kudsk presents a knowledge-driven decision support system for weed control that offers herbicide dose suggestions based on a large database of the existing knowledge of herbicides and herbicide efficacies.

We are very delighted to have included in this book a set of high-quality and interesting pieces of research, authored by researchers and industrial partners coming from different research institutions, universities, and companies across different continents. We are grateful to all reviewers and authors for the collaboration and work they have put into this book. We especially want to thank Daniel Power for writing the introductory chapter that introduces the main concepts that define a decision support system and prepares the readers for the remaining chapters of this book.

We hope that you will also enjoy reading the book, and we hope the presented “good” and “bad” practices on developing and using a decision support system can be useful for your research.

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