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A RAND Research Study

ACADEMIC PRESS, INC.
Harcourt Brace Jovanovich, Publishers
Boston San Diego New York
London Sydney Tokyo Toronto

Composition *Professional Book Center*

This book is printed on acid-free paper. ∞

ACADEMIC PRESS, INC.
1250 Sixth Avenue, San Diego, CA 92101

United Kingdom Edition published by
ACADEMIC PRESS LIMITED
24–28 Oval Road, London NW1 7DX

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Library of Congress Cataloging-in-Publication Data:

Building organizational decision support systems / Grace M. Carter ... [et al.].
p. cm
Includes bibliographic references.
ISBN 0-12-732070-9 (alk. paper)
1. Decision support systems. I. Carter, Grace M.
T58.62.B86 1992
658.4'03--dc20 92-19077
CIP

PRINTED IN THE UNITED STATES OF AMERICA

92 93 94 95 BC 9 8 7 6 5 4 3 2 1

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Preface

OVERVIEW

Early descriptions of decision support systems (DSSs) were based on the paradigm of a single decisionmaker at a stand-alone terminal or microcomputer who had a specific decision (nonrepetitive, semi-structured) to make. (Some of the early literature even recommended matching the user interface to the "cognitive style" of the decisionmaker). However, recent advances in computer technology, information systems, and telecommunications (collectively referred to as *information technology*, or IT) have facilitated a broadening of the scope of a DSS to include organizational units and, in some cases, entire organizations. Such systems are called "organizational decision support systems" (ODSSs).

Successful designing and implementation of ODSSs will be increasingly critical to the success of organizations—especially large ones with geographically dispersed operations or foreign subsidiaries. Organizations have been evolving to take advantage of the capabilities offered by IT, and, conversely, IT has facilitated dramatic changes in how organizations operate. The multinational corporations of the 1970s, which were really separate companies loosely coupled at the top, have given way to truly integrated global corporations, structured as a global web of operations

instead of a multinational pyramid. IT makes such an organization possible. Organizational decision support systems help make it successful.

ODSSs are not simply larger versions of a single-user DSS. There are important differences. These differences lead to critical differences in how ODSSs should be designed, developed, and maintained. This book highlights the differences and provides guidance to those who are engaged in building an ODSS. The guidance is not only theoretical (e.g., based on recommended approaches in the DSS and MIS literature), but is based on the authors' experience in building an ODSS for the United States Air Force. The system, called the Enlisted Force Management System (EFMS), is being used to help members of the Air Staff in the Pentagon make decisions related to their enlisted personnel. The three basic building blocks of an ODSS are the same as those of a traditional DSS (TDSS):

- model base (and model management system)
- database (and database management system)
- user interface (a dialog system that manages the interaction between the user and the other two components)

But an ODSS includes two additional components: a case management system, to facilitate assembling and cataloging the input data for model runs and to keep track of the output from the runs, and a communications system that allows users to communicate and cooperate with each other and with the models and data in the process of organizational decisionmaking.

An ODSS involves many users in loosely-linked parts of an organization operating a multitude of models that are fed by a number of databases. A well designed ODSS can provide central guidance and generalized control from top management to the individual decisionmakers, while permitting them (and helping them) to make their separate decisions. As a result, decisions made throughout the organization will be consistent with organizational goals and management's shared interpretation of its operational environment, while individual decisionmakers will simultaneously enjoy a maximum degree of freedom and independence.

The size, scope, and cost of an ODSS makes it very visible, and requires that its development be more carefully planned and managed than a TDSS. Because it is so visible and crosses organizational boundaries, successful implementation of an ODSS depends as much on political considerations as on technological considerations.

The key to a successful information system, as a growing body of applied research on organizations suggests, is the process by which the technology is introduced. This book deals with the process of building an organizational decision support system, from needs assessment and project formation, through conceptual design, to system implementation, maintenance, and updating. It addresses the technical issues involved in building models, creating databases, and choosing hardware and software. In fact, most of the book is devoted to these issues. But it also addresses political issues that have to be faced, such as the roles of the various organizational units, turf battles, and the composition and management of the project team. As Woolsey [1989] has said: "I have never seen an OR/MS/MIS system fail because of an insufficient level of technology, but I have seen such systems fail—big time—because the level of expertise related to people issues was nowhere near that dealing with technical matters."

The book has been written for those who are, or may become, involved in the development of an ODSS. This includes ODSS users, the analysts who may be developing the models for an ODSS, the programmers and information systems personnel who may be writing its programs or developing its databases, the information systems managers who might be leading the ODSS development project, and the top managers who might be considering introducing an ODSS into their organization. Much of the book is written in clear, nontechnical language. However, some of the information for the analysts and implementors is slightly more technical. These parts can be skipped by nontechnical readers.

This book is unique in the DSS literature, for three reasons. First, although there are many books that treat the concepts of decision support systems and how to build a DSS, there are no "how-to" books that are based on the experience of actually building one. Second, although there are many books on decision support systems, there are no books on ODSS's. Third, this book treats many issues concerned with the building of a DSS that are not treated together in any other DSS book. These include:

- The effort and pitfalls in managing the development of a large ODSS
- Organizational and political issues
- Relationships among modeler, implementor, and user
- Data gathering and cleaning
- Building analytical databases
- Modeling

- Integrating models
- Implementation
- Documentation
- Maintenance
- Updating and refitting models

The book provides step-by-step guidance to those who are engaged in building an ODSS. The guidance is not only theoretical (e.g., based on recommended approaches in the DSS and MIS literature), but is based on the experiences that the authors had in building an ODSS for the United States Air Force. The system, called the Enlisted Force Management System (EFMS), is being used to help members of the Air Staff in the Pentagon make decisions related to their enlisted personnel. The book weaves together principles for designing and building an ODSS with illustrative examples from the EFMS that show how the principles were applied. Because of its size and scope, the EFMS presented the development team with almost every conceivable challenge that might be faced in building an ODSS. We hope that the use of EFMS examples brings the ODSS development process alive for the reader.

ORGANIZATION

The book is divided into five major parts. Part I is primarily definitional and conceptual. It describes the decisionmaking environment within which an ODSS must function, decision aids in general, and ODSSs in particular. It specifies some principles that underlie the design of an ODSS, and the implications of those principles for the components of the system. Part II provides information on the Air Force's EFMS that is needed later to illustrate the points being made. Some of this discussion may be somewhat arcane to the general reader with little interest in Air Force personnel matters. But we feel that the gains of becoming familiar with this material outweigh the costs. Among the important gains is that the illustrations can delve into technical problems and political issues in a way that would be impossible if they were based on artificial examples with a less rich context.

Part III describes the process of building an organizational decision support system. It discusses the activities that are required and the issues (technical and managerial) that must be dealt with. It compares this process to those used to develop a traditional DSS and to develop a traditional

management information system (the "System Development Life Cycle" approach).

Part IV deals with building models for inclusion in an ODSS. It begins with first principles concerning decision models—what they are and how they vary. It then discusses more complicated issues, such as how many models the system should contain, simplicity vs. realism, fitting the models, prototyping, and test and evaluation. Models are at the heart of an ODSS. As Brennan and Elam [1986] wrote:

"All decision making involves predicting the likely consequences of decisions, which suggests that the decision maker should have a "model" of the problem situation being faced. The majority of DSS in use today do not attempt to represent this model explicitly, but rather provide access to data that can be utilized by an implicit, internalized model. One way to increase the quality of solutions produced by DSS is by incorporating explicit models of the decision making environment."

While portions of Part IV are aimed at the analyst and modeler, Part IV's basic intention is to present for all readers the core concerns about models essential to building an ODSS.

Part V focuses on issues related to the implementation of an ODSS. It deals with the technical issues of programming, designing user interfaces, building the system's databases, preparing documentation, and updating the system. But it also covers less technical issues, such as project management, relationships with users, and transferring models from the analysts to the implementors. An understanding of these issues and a sensitivity to their importance will go far to determining whether the ODSS will be successfully implemented and used.

ACKNOWLEDGMENTS

The EFMS was a joint product of the RAND Corporation and the U.S. Air Force. Warren Walker was RAND's project leader throughout the ten-year EFMP effort and Robert Walker was the Air Force's project leader during the EFMP's first seven years. Murray and Carter were senior researchers on the project from its inception to its end. In all, more than 100 individuals contributed to the building of the EFMS. (Their names are listed in the final report on the EFMP [Walker and the Enlisted Force Management Project Team, 1991].) The lessons we draw in this book are further fruits of those individuals' labors. The authors are indebted to all

who worked to build the EFMS, but several people deserve special mention.

Jan Chaiken participated in the conceptual design of the EFMS and his work left a mark on the project throughout its life. Marygail Brauner joined the project in its early days and set a high standard for carefulness and insight. Col. Robert Barnhardt played an early key leadership role across a wide range of project functions and activities. Peter Rydell joined the EFMP midstream and infused the project with a concern for users' views of the unfolding system. Generals J.B. Davis, W. Scott Harpe, and Robert Oaks supported the EFMP effort at critical junctures. Col. James Sampson succeeded Robert Walker as the Air Force's project leader for the EFMP and successfully brought the system through its final transition from development to full implementation. The collaborative research efforts of three Air Force officers, Joseph Cafarella, Glenn Clemens and Kevin Lawson, with their RAND counterparts, were essential to the integration of the RAND and Air Force system development work. Barbara Like masterfully cast our many drafts into a manuscript with a single format and coherent appearance. Robert Anderson and Gene Fisher made significant contributions to the content and organization of the book through their reviews of an early manuscript.

The book is truly a joint effort of the four primary authors. The outlines of the chapters were created at group brainstorming sessions. Draft chapters were critiqued and revised by us all. Robert Reding contributed extensive raw material for Part IV of the book. Allan Abrahamse co-authored Chapter 11. Dan Relles authored Chapter 9.

The creative exercise of writing a book is quite satisfying. The nitty gritty details of putting a book together are another matter altogether. The rest of us are grateful to Warren Walker for handling the myriad managerial details required for assembling this book, and for his fulfilling that same essential task throughout the EFMP. Warren managed our budgets, our staffs and our creative tensions while simultaneously conveying first to the EFMP and then to the book project the pulse of progress in the literature on Decision Support Systems.

Carter and Murray also want to note that the Walkers were from the outset the key champions of the EFMP. Few researchers would have had Warren's persistence in the face of the early difficulties with the client over specifying the initial models or the courage to continuously defend the project to management during the first few years when developing some early models took much longer than planned. Few Air Force officers

would have had Robert's independence of spirit to press the EFMP within the Air Force in the face of the substantial skepticism from several powerful individuals.

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January 1992

List of Acronyms

AFMPC	Air Force Military Personnel Center
AFSC	Air Force Specialty Code
APM	Authorization Projection Model
ATC	Air Training Command
BEM	Bonus Effects Model
BMT	Basic Military Training
CJR	Career Job Reservation
CMS	Case Management System
CPU	Central Processing Unit
CSCW	Computer-Supported Cooperative Work
DBA	Database Administrator
DBMS	Database Management System
DMDC	Defense Manpower Data Center
DMI	Disaggregate Middle-term Inventory Projection Model
DoD	Department of Defense
DOS	Date of Separation
DP	Deputy Chief of Staff for Personnel
DPP	Directorate of Personnel Programs
DPX	Directorate of Personnel Plans
DSS	Decision Support System

EAGL	Enriched Airman Gain/Loss (data file)
EFMP	Enlisted Force Management Project
EFMS	Enlisted Force Management System
EIS	Executive Information System
EMS	Electronic Meeting System
ESO	Equal Selection Opportunity
ETS	Expiration of Term of Service
GDSS	Group Decision Support System
GLS	Generalized Least Squares
HYT	High year of tenure
IPM	Inventory Projection Model
IT	Information Technology
MAJCOMs	Major Commands
MBMS	Model Base Management System
MIS	Management Information System
MMS	Model Management System
MTL	Middle-term Disaggregate Loss Module
NCO	Non-commissioned Officer
NPS	Non-prior Service
ODSS	Organizational Decision Support System
OETS	Original Expiration of Term of Service
OLS	Ordinary Least Squares
PACE	Processing and Classification of Enlistees (data file)
PDGL	Promotion, Demotion, Gain, Loss (data file)
PE	Prediction Error
PEPNR	Percent of Number at Risk
PPB	Planning, Programming, and Budgeting
PR	Programs and Resources
PRE	Percent Relative Error
PRM	Directorate of Manpower and Organization
RAM	Random Access Memory
SAM	Short-term Aggregate Inventory Projection Model
SAMFBYL	Short-term Aggregate Model, Force by Year Listing
SDLC	System Development Life Cycle
SMO	System Management Office
SPE	Standardized Prediction Error
SQL	Structured Query Language
SRB	Selective Reenlistment Bonus
T&E	Test and Evaluation

TDSS	Traditional Decision Support System
TIG	Time in Grade
TIS	Time in Service
TOPCAP	Total Objective Plan for Career Airman Personnel
TPR	Trained Personnel Requirements
UAR	Uniform Airman Record (data file)
YAR	Year at Risk (data file)
YETS	Years to ETS
YOS	Year of Service
YOSTG	Year of Service Target Generator

Contents