

Decision Methodology

A formalization of the O R process

D. J. WHITE

*Professor of Decision Theory
University of Manchester*

A Wiley-Interscience Publication

JOHN WILEY & SONS

London . New York . Sydney . Toronto

Contents

| | <i>Page</i> |
|---|-------------|
| 1 Decision Analysis Outline | 1 |
| 1.1 Introductory Remarks | 1 |
| 1.2 The Subject Matter and the Methodology of Decision Analysis | 2 |
| 1.3 Techniques of Decision Analysis | 5 |
| 1.4 Methodological Formats of Decision Analysis | 9 |
| 1.5 The Role of Techniques in Decision Analysis | 14 |
| 1.6 Decision Methodology, Theory of Choice and of Object System and Techniques of Solution | 15 |
| 2 Decision Analysis Phases | 17 |
| 2.1 Primary Problem Formulation Phase | 17 |
| 2.1.1 Definition | 17 |
| 2.1.2 The Ultimate Decisionmakers | 20 |
| 2.1.3 Types of Decision | 22 |
| 2.1.4 Specification of Alternatives | 27 |
| 2.1.5 Consequences | 33 |
| 2.1.6 Criteria | 42 |
| 2.1.6.1 Criteria for Different Problem Areas | 43 |
| 2.1.6.2 Some Special Points on Criteria | 52 |
| 2.1.7 Forms of Primary Problem Statement | 59 |
| 2.1.8 Importance of Proper Problem Formulation | 62 |
| 2.2 Object System Model Phase | 64 |
| 2.2.1 Introductory Remarks | 64 |
| 2.2.2 Mathematical Models, Quantification and Measurement | 72 |
| 2.2.2.1 Mathematics | 72 |
| 2.2.2.2 Statements and Expressions | 75 |
| 2.2.3 Constructing the Model | 92 |
| 2.2.3.1 Identification and Definition of Variables | 93 |
| 2.2.3.2 Identification of Relations | 111 |
| 2.2.4 Estimating and Testing for Models | 131 |
| 2.2.5 Controlling the Model | 138 |

| | |
|---|------------|
| 2.3 The Solution Phase | 139 |
| 2.3.1 Forms of Solution | 139 |
| 2.3.2 Problem Solution Procedure Characteristics | 139 |
| 2.3.3 Comparing Solutions | 156 |
| 2.3.4 Verifying the Method | 157 |
| 2.3.5 Quick Methods of Solution | 157 |
| 2.3.5.1 The Exclusion Principle | 158 |
| 2.3.5.2 Infrequent Contingencies Principle | 164 |
| 2.3.5.3 Dominant Variable Principle | 177 |
| 2.3.5.4 Independent Marginal Improvement Principle | 178 |
| 2.3.5.5 Present Decisions and Future Time Patterns Robustness Principle | 181 |
| 2.3.5.6 Combined Methods Principle | 182 |
| 2.3.5.7 Grouping Principle | 184 |
| 2.3.6 Choice of Model and Solution Method | 190 |
| 2.3.7 Uncertainties and Choice of Solution Procedure | 191 |
| 3 Methodological Decisions and Suboptimization | 194 |
| 3.1 The Nature of Suboptimization | 194 |
| 3.1.1 Introductory Remarks | 194 |
| 3.1.2 Faithfulness, Insight and Suboptimality | 195 |
| 3.1.3 A Framework | 196 |
| 3.1.3.1 Incomplete Consequences | 197 |
| 3.1.3.2 Prior and Posterior Evaluations | 198 |
| 3.1.3.3 Degree of Suboptimality | 198 |
| 3.2 Sources of, and Approaches to, Suboptimization | 200 |
| 3.2.1 Suboptimization via Alternatives | 200 |
| 3.2.2 Suboptimization via Consequences | 213 |
| 3.2.3 Suboptimization via Relations | 217 |
| 3.2.4 Suboptimization via Values | 225 |
| 3.3 Suboptimizing as a Decision Problem | 229 |
| 3.4 Bounded Computational Rates | 230 |
| 4 Further Aspects of Decision Methodology | 234 |
| 4.1 Introduction | 234 |
| 4.2 Data Problem and Choice of Problem Area | 235 |
| 4.3 Communication and Involvement | 241 |
| 4.4 Implementation | 244 |
| 5 Exercises | 248 |
| References | 260 |
| Index | 267 |