

# **Management Science, Operations Research and Project Management**

JOSE RAMON SAN CRISTOBAL MATEO  
*University of Cantabria, Spain*

I

**GOWER**

# Contents

<i>List of Figures</i>		<i>vii</i>
<i>List of Tables</i>		<i>ix</i>
Introduction		1
<b>1</b>	<b>Network Models</b>	<b>13</b>
	Types of Network Representations	13
	Characteristics of Network Models	16
	Types of Networks	19
	Decision-CPM Model	20
	Generalized Network Model	29
	Decision Box Network	30
	Graphical Evaluation and Review Technique (GERT)	33
	Venture Evaluation and Review Technique (VERT)	42
	Generalized Alternative Activity Network Model (GAAN)	44
<b>2</b>	<b>Multi-Objective Decision-Making Models</b>	<b>49</b>
	Linear Programming Formulation of the Time-Cost Trade-off Problem	49
	A Linear Time-Cost Trade-off Model to Find the Critical Path	54
	Fuzzy Linear Programming	56
	Goal Programming	63
	An Integer Programming Problem	67
<b>3</b>	<b>Multi-Criteria Decision-Making Models</b>	<b>73</b>
	Multi-Attribute Utility Theory	73
	The VIKOR Method	83
	The TOPSIS Method	85
	Fuzzy PROMETHEE Method	90
<b>4</b>	<b>Game Theory</b>	<b>101</b>
	Game Theory	102
	The Shapley Value	105

	Allocation of Benefits Resulting from Cooperative Behaviour	
	Using the Shapley Value	106
	The Core	108
	A Cost-Allocation Method Based on the Core	110
	Float Allocation Using Game Theory	114
<b>5</b>	<b>Dynamic Programming</b>	<b>121</b>
	Dynamic Programming	121
	A Multi-Project Investment Problem	123
	Dynamic Programming Formulation of the Time-Cost Trade-off Problem	126
<b>6</b>	<b>Forecasting Models</b>	<b>133</b>
	Forecasting	133
	Linear Regression	134
	Grey Methodology	140
	The GM (1,1) Model	141
	Earned Value Management	150
<b>7</b>	<b>Simulation Models</b>	<b>157</b>
	A Simulation Model with Random Numbers	158
	Artificial Intelligence	162
	Expert Systems	162
	Artificial Neural Networks	169
<b>8</b>	<b>Markov Models</b>	<b>173</b>
	Markov Chain	175
	Risk Analysis Based on Markov Chains	183
<b>9</b>	<b>Data Envelopment Analysis Models</b>	<b>187</b>
	Data Envelopment Analysis	190
	<i>References</i> †	199
	<i>Index</i>	217