

# Contents

<i>Figures and tables</i>	vii
<i>Acknowledgements</i>	xiii
<b>1 Introduction</b>	1
1.1 Internationalization of the world economy	1
1.2 Research questions	5
1.3 Structure of the book	9
<b>2 Conceptual model</b>	13
2.1 Integral chain of operations	13
2.2 Supply of input materials	15
2.3 Manufacturing process	18
2.4 Distribution of finished products	21
2.5 Cost consequences of variations in plant location and annual plant capacity	25
2.6 Factors in a firm's international environment	26
2.7 Practical evidence	30
<b>3 Literature review</b>	33
3.1 Explaining international manufacturing	33
3.2 Economies of scale	43
3.3 Quantitative allocation models	52

<b>4 Design method</b>	<b>61</b>
4.1 Strategic decision-making processes	62
4.2 Decision support systems	68
4.3 Design method for international manufacturing and logistics	73
4.4 Potential sources of evidence	80
<b>5 Case studies</b>	<b>85</b>
5.1 Application of the proposed design method in five case studies	86
5.2 Relocation of manufacturing in the metal working industry	87
5.3 Reallocation of manufacturing in the food processing industry	95
5.4 Capacity expansion in the manufacturing of chemical specialties	104
5.5 Capacity expansion in the manufacturing of basic chemicals	115
5.6 Case comparison	126
5.7 Reflection on applications of the design method	134
<b>6 Evaluation of the design method</b>	<b>139</b>
6.1 Evaluation in the five case studies	140
6.2 Evaluation in a workshop with experienced managers	150
6.3 Concluding remarks	160
<b>7 Conclusions and recommendations</b>	<b>163</b>
7.1 Conclusions	163
7.2 Implications for internationally operating firms	165
7.3 Recommendations for further research	167
<i>Appendix A Background information on the metal case studies</i>	<b>171</b>
<i>Appendix B Background information on the Foodco case study</i>	<b>177</b>
<i>Appendix C Background information on the Chemspec case study</i>	<b>184</b>
<i>Appendix D Background information on the Chembasic case study</i>	<b>192</b>
<i>List of references</i>	<b>199</b>

# Figures and tables

Figure 1.1	Example of a manufacturing and logistics structure	6
Figure 1.2	Outline of the book	9
Figure 2.1	Integral chain of operations	14
Figure 2.2	Conceptual model of a multinational's chain of operations	15
Figure 2.3	Classification of input materials	16
Figure 2.4	Manufacturing process and its input requirements	18
Figure 2.5	Typology of labour categories	19
Figure 2.6	Main activities in the distribution process	22
Figure 2.7	Four basic types of international distribution structures	23
Figure 2.8	Relevance of various types of distribution costs based on the value density and packaging density	24
Figure 2.9	Relationship between the independent variables plant location and annual plant capacity and total costs	26

Figure 2.10	Effective corporate income tax burden in Dutch multinationals	28
Table 2.1	Examples of decisions on the (re)design of international manufacturing and logistics structures	30
Table 3.1	Ricardo's concept of comparative advantage	34
Table 3.2	Main locational determinants in Van de Ven's case studies	43
Figure 3.1	Economies of scale at the plant level	45
Table 3.3	Engineering estimates of the minimum efficient plant size in selected industries	48
Table 3.4	Summary of quantitative allocation models	53
Figure 4.1	Phase model of strategic decision-making processes	63
Figure 4.2	Support in decision-making processes	69
Figure 4.3	Proposed design method to support decisions regarding a multinational's manufacturing and logistics structure	73
Table 4.1	Sources of evidence in applications of the design method	81
Table 5.1	General data regarding the five case studies	85
Table 5.2	Application of the design method in five case studies	87
Table 5.3	Main differences between two relocation studies in the metal working industry	88
Table 5.4	Summary of relevant costs in existing plants of Metal 1 and Metal 2	90
Figure 5.1	Comparison of annual costs in Metal 1's case study	92
Figure 5.2	Comparison of annual costs in Metal 2's case study	93

Figure 5.3	Foodco's annual sales and manufacturing output (1989)	96
Figure 5.4	Supply and manufacturing costs in Foodco's plants	97
Figure 5.5	Labour requirements for four model plants	99
Figure 5.6	Capital requirements for four model plants	99
Figure 5.7	Manufacturing costs per unit in the four model plants and in Foodco's existing plants	101
Figure 5.8	Estimated restructuring costs and discounted savings over a five-year period for three alternative manufacturing structures in the food industry	103
Figure 5.9	Geographical breakdown of Chemspec's sales	106
Figure 5.10	Unit manufacturing costs in Chemspec's plants (1990)	106
Figure 5.11	Labour requirements for an annual capacity of 300,000 units of chemical specialties in one and two plants	108
Figure 5.12	Capital investments for an annual capacity of 300,000 units of chemical specialties in one and two plants	108
Figure 5.13	Estimated annual profit before taxes at various European locations of plant X	112
Figure 5.14	Manufacturing and supply costs in Chembasic's plants (1990)	116
Figure 5.15	Labour and capital costs per unit in four model plants for the manufacturing of basic chemicals	119
Figure 5.16	Effects of locational price differences within Western Europe on the costs per unit of basic chemicals	120

Figure 5.17	Effects of a capacity expansion in Chembasic's main European markets on the cumulative DCF	122
Figure 5.18	Effects of a capacity expansion in the southern part of country 3 on the cumulative DCF	123
Figure 5.19	Estimated internal rate of return for various capacity expansion scenarios	124
Table 5.5	Characteristics with respect to the plant capacity variable	127
Table 5.6	Ranking of location factors and the values of relevant ratios in the five case studies	130
Table 5.7	Sources of evidence consulted in the five case studies	134
Figure 6.1	Outline of the decision-making process in Metal 1's case	141
Figure 6.2	Outline of the decision-making process in Metal 2's case	143
Figure 6.3	Outline of the decision-making process in Foodco's case	145
Figure 6.4	Outline of Chemspec's decision-making process	147
Figure 6.5	Outline of Chembasic's decision-making process	149
Table 6.1	General data on the workshop's participants	151
Table 6.2	Main contents of the group processes	153
Figure 6.6	Judgement regarding the design method's value in terms of decision support	155
Figure 6.7	Perceived value of the plant location analysis	156
Figure 6.8	Perceived value of the plant capacity analysis	157
Figure 6.9	Desirability of external support	158

Figure 6.10	General impressions of the workshop's value	159
Table A.1	Comparison of plants visited in Poland and the Czech Republic	172
Table A.2	Comparison of two Chinese plants with Metal 2's existing plant	174
Figure B.1	Foodco's European manufacturing structure (1990)	177
Figure B.2	Manufacturing processes for Foodco's type of products	178
Figure B.3	Labour productivity in Foodco's manufacturing plants	179
Table B.1	Summary of data on Foodco's existing manufacturing plants	180
Table B.2	Labour and capital requirements in four model plants	182
Table B.3	Unit transportation costs for three alternative structures	183
Figure C.1	Main manufacturing and sales quantities in Chemspec's industry (1978-1988)	184
Figure C.2	Chain of operations for chemical specialties	185
Figure C.3	Estimated annual capacity of the main European manufacturers of chemical specialties (1990)	187
Table C.1	Estimated effects of locational differences on the operating profit	188
Table C.2	Estimated average transportation tariffs and annual transportation costs for alternative European plant locations	190

<b>Figure D.1</b>	<b>Main competitive forces in Chembasic's environment</b>	<b>192</b>
<b>Figure D.2</b>	<b>Relationship between distance to customers and transportation costs per unit of basic chemicals (1990)</b>	<b>195</b>
<b>Table D.1</b>	<b>Labour and capital requirements for four plant capacity levels</b>	<b>196</b>