

Contents

Foreword	<i>xiii</i>
Acknowledgments	<i>xv</i>

Part 1 Agriculture and the Food Industry 1

1	The Role of Agriculture in Today's Food Industry	3
1.1	Introduction	3
1.1.1	The Four Building Blocks	4
1.1.2	Some History of Agriculture	5
1.1.3	Eat More and Increase the Likelihood for Survival	6
1.1.4	Food Can Be Grown and Plants Can Be Bred: What's Next?	7
1.1.5	From Very Old to Rather Recent Food-Preservation Techniques	9
1.2	Agriculture: The Main Supplier to the Food Industry	10
1.2.1	Artificial Ingredients	10
1.2.2	The Main Raw Material Sources	11
1.2.3	Milk's the Star	12
1.2.4	Milk...What Else?	13
1.2.5	Other Excursions from Food	14
1.2.6	Noncompeting Alternatives	15
1.3	Agriculture's New Role in Light of Food and Health	16
1.3.1	Decades of Food Safety Rules and Regulations	18
1.3.2	More Rules: What Do We Do?	20
1.3.3	Raw Materials and Processes Become More Sophisticated	21
1.4	Most Likely Drivers for Change in the Agriculture Industry	23
1.5	Summary and Major Learning	25
	References	27

- 2 **Water Management in Modern Agriculture: The Role of Water and Water Management in Agriculture and Industry** 29
 - 2.1 Introduction 29
 - 2.2 Multiple Dimensions of Water 30
 - 2.3 On the Evolution of Water Institutions and Policies 33
 - 2.4 Reforming Water-Resource Management at the Micro-Level (Farm and Field) 35
 - 2.5 Reforming Regional Water-Allocation Regimes 38
 - 2.6 Improved Water Project Design 42
 - 2.7 Improved Water Quality 43
 - 2.8 Climate Change 44
 - 2.9 Summary and Major Learning 46
 - References 47

- 3 **Innovation in Plant Breeding for a Sustainable Supply of High-Quality Plant Raw Materials for the Food Industry** 53
 - 3.1 Introduction 53
 - 3.2 Challenges for Future Agricultures and Food Industries 54
 - 3.2.1 Strongly Growing Food Needs 54
 - 3.2.2 Energy Issues 56
 - 3.3 Genetic-Based Techniques for Plant Breeding in the Context of Agricultural Production 59
 - 3.3.1 Genetic Innovation and Agronomic Practices 59
 - 3.3.2 The Process of Plant Breeding and Its Main Limitations 61
 - 3.3.3 Preliminary Conclusions 67
 - 3.4 Trends: Shift in Allocation of Resources to Global Needs? 68
 - 3.4.1 Methodology 68
 - 3.4.2 Analysis of Investment in Seed Research and Development 69
 - 3.4.3 Analysis of Deviations and Distortions of R&D Investments and Production Volumes 71
 - 3.5 A First Set of Conclusions and Recommendations 77
 - 3.6 Summary and Major Learning 80
 - 3.7 Appendix Tables 81
 - References 85

- 4 **The Agriculture of Animals: Animal Proteins of the Future as Valuable and Sustainable Sources for the Food Industry** 87
 - 4.1 Livestock and Animal Husbandry 87
 - 4.1.1 How We Got to Now 88
 - 4.2 Animals: A Source of High-Quality Proteins 89
 - 4.3 Animal Protein Demand in Emerging Markets 90
 - 4.4 Optimal Animal Welfare: Sustainable, Humane, and Healthy 93

- 4.4.1 Animal Production Increase 95
- 4.5 Animal-Breeding Programs 97
- 4.5.1 Genomic Breeding of Animals 98
- 4.6 The Use of Big Data for Management and Genetic Evaluations 102
- 4.7 Summary and Major Learning 106
- References 108

Part 2 The Future of the Food Industry 109

- 5 The Food Trends—The New Food—Enough Food? 111**
- 5.1 Historical Food Trends: From Then to Now 111
- 5.1.1 Food and Beverages during the Period of Classical Greece 111
- 5.1.2 Food and Beverages in the Roman Empire 113
- 5.1.3 Food in Medieval Times in Central Europe 115
- 5.1.4 From European Renaissance and Enlightenment to the First Industrial Revolution 118
- 5.1.5 Food in the 20th Century: The Real Food Revolution 121
- 5.2 Present-Day Food Fashions and Trends: A Never-Ending Story 124
- 5.2.1 Food and Nutrition Trends: A Story of Perception, Deception, and Beliefs 125
- 5.3 New Food Sources: New Protein Sources 128
- 5.3.1 Insects: A New Food Source? 129
- 5.3.2 Increased Food Security through Exploiting New Protein Sources 130
- 5.3.3 A “Crazy” Idea for Other Food Sources: Beyond Proteins 131
- 5.4 Vegetarian Food and Its Potential Societal and Economic Impact 132
- 5.5 Urban Gardening and Urban Agriculture 134
- 5.5.1 The Urban Bee-Highways 136
- 5.6 Summary and Major Learning 137
- References 138

- 6 The New Food Industry Business Model: From B2C to B2B, from Product Manufacture to Selling Know-How, and from Now to Then 141**
- 6.1 The Old: Develop, Manufacture, and Sell (“Demase”) 141
- 6.1.1 The Fall of the Righteous 142
- 6.2 The New: The Customer Is King, the Consumer Is an Enabler, and from B2C to B2B 144
- 6.2.1 Slotting Allowance 145
- 6.2.2 Retailers Become the Most Important Partners for Food and Beverage Companies 146
- 6.2.3 How This Could Work: A Possible Path and Examples 147

- 6.3 From Selling Products to Selling Know-How 150
 - 6.3.1 The Knowledge-Centric Company 152
 - 6.3.2 Engaging, Interacting, and Selling: The New Etiquette 154
- 6.4 The Community of Consumers: It's What They Want that Counts! 155
 - 6.4.1 The Consumers Become Involved 158
- 6.5 Food-Related Trends and Hypes in Today's Societies: An Outlook to the Future 161
- 6.6 Summary and Major Learning 163
References 165

- 7 The Internet of Just about Everything: Impact on Agriculture and Food Industry 167**
 - 7.1 Modern Cooking: Forward to the Past 167
 - 7.1.1 The Role of Robotics and Connectivity 169
 - 7.2 Everything Is Online and Everyone Is Online—All the Time 171
 - 7.3 Food and Agriculture: The New Hardware and Software 174
 - 7.3.1 Big Data Are Here to Stay 176
 - 7.3.2 Agriculture and Space Science: The New Connection 176
 - 7.3.3 Impact on the Food Industry and the Consumer in the Middle 178
 - 7.4 An Attempt at Peaking Ahead: Will There Still Be an Agriculture or Food Industry? 179
 - 7.4.1 Bigger Is Not Always Better 180
 - 7.4.2 Elements that Will Stay and Others that Might Disappear 182
 - 7.5 Summary and Major Learning 186
References 189

- 8 Nutrition: The Old Mantra ... the New Un-Word 191**
 - 8.1 Nutrition: What's All the Fuss about? 191
 - 8.1.1 The Hottest New Food Trends 192
 - 8.1.2 The Debate Continues: What's Good and What's Not Good for You? 195
 - 8.1.3 And Here We Go Again: Fasting Can Do You an Awful Lot of Good 196
 - 8.1.4 A Few Simple Tips When It Comes to Healthy and Happy Eating 197
 - 8.2 A Bit of Nutrition History 198
 - 8.2.1 Low and Reduced, Lower and "Reduced-Er": Low or Reduced Fat 202
 - 8.2.2 Low or Reduced Salt 203
 - 8.2.3 Low or Reduced Sugar and No Sugar 204
 - 8.2.4 Low Saturated Fats, Good Monounsaturated Fats, More Polyunsaturated Fats, and Lots of Ω 3 Fats 206

- 8.3 Typical Nutrition Controversies 208
- 8.3.1 So Many Recommendations...Too Many? 208
- 8.3.2 More Controversies 210
- 8.4 Food and Claims, Food and Benefits 211
- 8.5 Summary and Major Learning 214
- References 217

Part 3 The New Food World 219

- 9 A Food Company Transforms Itself 221**
- 9.1 The Not-So-New Realities 221
- 9.1.1 Automation Is Here...For Quite Some Time Actually 223
- 9.1.2 The Novel Directions in Food and Agriculture are Governed by Regulatory Involvement 225
- 9.1.3 All-Natural Industrial Food Products: The Way Forward? 226
- 9.2 From Product to Know-How Seller: An Encore 227
- 9.2.1 Some Assumptions as to How This May Function 228
- 9.2.2 What are Possible Consequences for Food Ingredient Suppliers? 230
- 9.3 Anticipating the Inevitable: Possible Scenarios 234
- 9.3.1 Possible Future Models and Scenarios 238
- 9.3.2 The Return Of Medical Food? 239
- 9.4 Reality or Fiction? Reality and Fiction! 241
- 9.4.1 A New Manufacturing Reality 242
- 9.5 Summary and Major Learning 244
- References 246

- 10 Food for the Future: A Future for Food 247**
- 10.1 Proactive Agriculture 247
- 10.1.1 What If Agriculture Anticipated Real Food Requirements and Trends? 249
- 10.2 Democratized Agriculture 252
- 10.2.1 Agrihood 253
- 10.2.2 Permaculture 254
- 10.2.3 From Large to Small 259
- 10.2.4 The Growing Role of Urban Agriculture: Self-Centeredness or Community Driven? 261
- 10.3 Agriculture and Food Manufacture in Exotic Places 264
- 10.3.1 An Ice Cream Factory in Greenland? 265
- 10.3.2 A Chocolate Factory in Ghana? 266
- 10.4 A Future for Food 269
- 10.4.1 What about the Role of Restaurants? 269

- 10.4.2 Pet Food Is Food, Too 270
- 10.4.3 Will We Eat Food in Pill Format? 271
- 10.5 Summary and Major Learning 273
 - References 274

- 11 Summary and Outlook 277**
 - 11.1 Introduction 277
 - 11.1.1 The Role of Agriculture in Today's Food Industry 278
 - 11.1.2 Food-Preservation Techniques 279
 - 11.1.3 Agriculture Is the Main Raw Material Supplier to Be Transformed to Food 280
 - 11.1.4 Nonfood Uses of Agricultural Raw Materials 280
 - 11.1.5 Agriculture in a World of Rules and Regulations 280
 - 11.1.6 Food Raw Materials and Process Became More Sophisticated and Complex 281
 - 11.2 Water Management in Modern Agriculture 281
 - 11.2.1 The "Water Reform" 282
 - 11.2.2 Water Productivity 282
 - 11.2.3 Water-Related Government Policies 283
 - 11.2.4 Getting It Right: Policies and Price 283
 - 11.2.5 Controlling Water Quality 284
 - 11.3 Innovation in Plant Breeding: High-Quality Plant Raw Materials for the Food Industry 285
 - 11.3.1 Agricultural Plant Output: The Essential Raw Material Source for the Food Industry 285
 - 11.3.2 Demand Forecast Based on Food Requirements 285
 - 11.3.3 Genetic Improvement of Cultivated Crops 285
 - 11.3.4 The Major Crops versus "Orphan Crops" 286
 - 11.4 The Agriculture of Animals: Valuable and Sustainable Sources for the Food Industry 286
 - 11.4.1 Growing Population: Growing Amount of Livestock 287
 - 11.4.2 Animal Health and Intensive Farming 287
 - 11.4.3 Animal Breeding 287
 - 11.4.4 Good Farm Management: Good Data Management 288
 - 11.5 The Food Trends—the New Food—Enough Food? 288
 - 11.5.1 Food and Beverage Fashions and Trends of the Past 289
 - 11.5.2 The "Real" Food Revolution of the 20th Century 289
 - 11.5.3 Present-Day Food and Nutrition Trends 290
 - 11.5.4 New Food Sources: New Protein Sources 290
 - 11.5.5 Vegetarian Food and Its Impact on Society 291
 - 11.5.6 The Role of Urban Agriculture and Bees 291
 - 11.6 New Business Models for the Food Industry 292

- 11.6.1 From “Consumer Is King” to “Customer Is King”: Retailers Become Real Partners 292
- 11.6.2 Good-Bye to Selling Products and Hello to Selling Know-How 293
- 11.6.3 Consumers Become Involved 294
- 11.7 The Internet of Just about Everything and What This Means for Agriculture and Food 295
 - 11.7.1 Modern Cooking: A Brief Look to the Past 295
 - 11.7.2 Robotics and Connectivity 295
 - 11.7.3 Food and Agriculture: Big Data 296
 - 11.7.4 Will There Still Be Agriculture and Food Industries? 296
 - 11.7.5 What Will Remain, and What Will Disappear? 297
- 11.8 Nutrition: What Else? 298
 - 11.8.1 Healthy and Happy Eating 299
 - 11.8.2 A Short History of Nutrition 300
 - 11.8.3 Nutrition Controversies 300
 - 11.8.4 Claims and Benefits 301
- 11.9 The Company Transforms Itself 301
 - 11.9.1 The Role of Automation: Threat or Blessing? 302
 - 11.9.2 Regulatory Involvement in the Industry 303
 - 11.9.3 The New Business Model 2.1 303
 - 11.9.4 Scenarios of Relevance for Food and Agriculture 303
 - 11.9.5 Medical Food: A Future? 304
 - 11.9.6 Reality or Fiction? 304
- 11.10 Agriculture Listens, Finally? 305
 - 11.10.1 Agriculture and Farming at the Fingertips of Everyone 306
 - 11.10.2 Small Is Beautiful 306
 - 11.10.3 Is Urban Agriculture a Sign of Self-Centeredness or Is It Community Driven? 307
 - 11.10.4 Manufacturing Food Where It Makes Sense 307
 - 11.10.5 What Role Do Restaurants Play? 308
 - 11.10.6 The Role of Pet Food in the Food Industry 308
 - 11.10.7 Food in the Format of Pills? Will Consuming Food Pills Be Part of Megatrends? 308

Index 311