

# Table of Contents

<b>Preface</b>	XIII
<b>1 Strategic Alignment in Operations and Supply Chain Management,</b> by <i>Alberto Grando</i>	1
1.1 Introduction	1
1.2 The scope of this book	1
1.3 The sustainability imperative	3
1.4 The new paradigm of the Circular Economy	7
1.5 Sustainability and operations management	8
1.6 Operations Strategy development	12
1.7 Order qualifier and order winner	14
1.8 Strategic choices and design levers	16
1.9 Operations Management and its link with the economic-financial perspective	18
<b>2 Design of Production Systems,</b> by <i>Alberto Grando</i>	25
2.1 Typological analysis of production processes	25
2.2 An overview of manufacturing processes	30
2.3 Summary of types of layout	34
<b>3 Problem Setting and Problem Solving in Operations Management,</b> by <i>Alberto Grando</i>	45
3.1 Physiology and pathology in Operations Management processes	45
3.2 Problem Setting and Problem Solving	46
3.3 A structured approach to Problem Setting and Problem Solving	49
3.4 The DMAIC method	51
3.5 Operations Management and performance measures	61
3.6 Performance measurement in Operations	63
3.7 The concept of trade-offs and PwP (plant-within-a-plant) strategies	67
3.8 Operations Management and Management Control	68
<b>4 Measurement of Performance in Operations Management: Service and Quality,</b> by <i>Alberto Grando</i>	71
4.1 The measures of service	71
4.2 The principal precautions in the construction of performance measures	71

4.3	The measure of performance prevalent in MTS systems	73
4.4	The measure of performance prevalent in ATO/MTO systems	73
4.5	The measure of common performance among different production systems	77
4.6	Mapping of flows and lead times	81
4.7	Measures of conformity and quality	83
4.8	The elements underlying quality measures	84
4.9	In-house conformity quality: Notions and measures	85
4.10	The costs of quality	89
<b>5</b>	<b>Measurement of Performance in Operations Management: Productivity and Flexibility, by <i>Alberto Grando</i></b>	91
5.1	The measures of productivity	91
5.2	The Key Performance Indicators linked to productivity	92
5.3	The productivity of factors: notions and measures	98
5.4	The measures of Versatility and Flexibility	100
5.5	Flexibility: notions and measures	103
<b>6</b>	<b>Production Planning and Control System, by <i>Alberto Grando</i></b>	109
6.1	Introduction	109
6.2	Production planning and types of production processes	109
6.3	Constraints and economic-financial profiles of planning choices	111
6.4	The Production Planning and Control Process over different time horizons	119
6.5	Planning Horizons and rolling plans	122
6.6	The Demand Plan	126
<b>7</b>	<b>Demand Forecasting, by <i>Valeria Belvedere</i></b>	129
7.1	Introduction	129
7.2	The Demand Plan	129
7.3	Qualitative techniques	130
7.4	Quantitative techniques	133
	7.4.1 Time series methods	133
	7.4.2 Causal methods	140
7.5	The measures of forecasting accuracy	142
7.6	The choice of forecasting technique	145
<b>8</b>	<b>Production Plan: Sales and Operations Planning, by <i>Alberto Grando</i></b>	153
8.1	The goal of Sales and Operations Planning	153
8.2	Sizing the Available Production Capacity	155
8.3	The Available Production Capacity from the standpoint of Total Productive Maintenance	161

8.4	S&OP process: the comparison between Required Production Capacity and Available Production Capacity	167
8.5	S&OP: the integration of different perspectives	170
<b>9</b>	<b>Inventory Functions and Control</b> , by <i>Alberto Grando</i>	175
9.1	Introduction	175
9.2	Type and functions of inventory	175
9.3	The traditional methods for Stock Control	179
9.4	The problems in determining measurements by value	181
9.5	The use of ABC curves and Inventory-Consumption matrix	185
9.6	The factors that influence stock levels	190
9.6.1	The characteristics of the production system	192
9.6.2	The characteristics of the product, the market, and the distribution systems	192
9.6.3	The relevant costs in the stock management	193
9.7	Stock management systems	196
<b>10</b>	<b>Inventory Control Methods for Independent Demand Goods</b> , by <i>Alberto Grando</i>	199
10.1	Setting stock levels in conditions of certainty	199
10.1.1	How much to produce or purchase: the Economic Order Quantity	199
10.1.2	When to purchase or produce: the Reorder Point	206
10.2	EOQ insights	207
10.3	Setting stock levels in conditions of uncertainty	208
10.4	The methods of stock control	215
10.5	Main characteristics of the stock control methods	230
<b>11</b>	<b>Production Planning and Control: The Master Production Schedule</b> , by <i>Alberto Grando</i>	233
11.1	The Master Production Schedule	233
11.2	Master Production Planning and Time-Phased Record	236
11.3	Rolling plans and Order Promising	238
11.4	MPS and management decisions	247
<b>12</b>	<b>Bill of Materials and Master Data</b> , by <i>Raffaele Secchi</i>	251
12.1	Introduction	251
12.2	The Bill of Materials (BOM)	251
12.2.1	Technical and management data	252
12.2.2	The management functions of the Bill of Materials	254
12.3	Planning Bill	258
12.3.1	Super Bill	259
12.3.2	Family Bill	266
12.3.3	Pseudo Bill	267
12.3.4	Inverted Bill	267

12.4	Product configurators	267
12.5	Production cycles	270
12.6	Production centers archive	271
<b>13</b>	<b>Stock Control Methods for Dependent Demand Goods and the Choice of the Appropriate Method</b> , by <i>Alberto Grando</i>	273
13.1	Look Ahead approach: Material Requirements Planning logic	273
13.2	The MRP record processing	277
13.3	Parameterizing MRP	280
13.4	The evolution of MRP systems	290
13.5	The sizing of the investment in stock and the selection of the most suitable management criterion	292
13.6	Empirical approaches	296
<b>14</b>	<b>Shop Floor Planning and Control</b> , by <i>Valeria Belvedere</i>	299
14.1	Introduction	299
14.2	Push scheduling systems	302
14.2.1	Optimization methods	302
14.2.2	One-machine case	304
14.2.3	Two-machine case	305
14.2.4	Heuristic methods with sequencing rules	305
14.3	Pull scheduling systems	307
14.4	Push/pull scheduling systems	311
14.4.1	Synchro MRP	311
14.4.2	Optimized Production Technology	314
<b>15</b>	<b>Procurement Management</b> , by <i>Giuseppe Stabilini</i>	319
15.1	The role of purchasing in business success	319
15.2	Management processes and logics	320
15.3	The organization and the purchasing process	322
15.4	Measurement of purchase performance	324
15.5	Strategic Sourcing and Procurement Mix	326
15.6	The product/service lever	327
15.7	The price lever	331
15.8	The communication lever	333
15.9	The supply channels lever	335
<b>16</b>	<b>Process of Selecting and Evaluating Suppliers</b> , by <i>Giuseppe Stabilini</i>	341
16.1	Introduction	341
16.2	The supplier selection and evaluation process	342
16.3	The depth and width of the selection and evaluation	343
16.4	The integrated vision of the process	345
16.5	The approach to evaluation	351

16.6	The ex-ante evaluation, potential	354
16.7	The ex-post evaluation, control tools	355
16.8	The methods of selection and evaluation of suppliers	356
16.8.1	Categorical method (“beauty contest”)	359
16.8.2	Analytic Hierarchy Process (AHP)	360
16.8.3	Total Cost of Ownership (TCO)	364
16.8.4	Linear weighted average model (Vendor Rating)	368
16.9	Use of information generated in the supplier selection and evaluation process	370
16.10	Conclusions	372
<b>17</b>	<b>Lean Management, Total Quality Management, Six Sigma,</b> by <i>Valeria Belvedere</i>	375
17.1	Lean Management	375
17.1.1	Lean principles	376
17.1.2	Value stream mapping	377
17.1.3	Standardization of work cycles and redesign of the layout	381
17.1.4	Workload balancing and “mixed model” production	382
17.1.5	Setup reduction	383
17.1.6	Total Productive Maintenance	384
17.1.7	5S	385
17.2	Total Quality Management	386
17.3	Six Sigma	391
17.3.1	Statistical Process Control	392
17.3.2	Design of Experiments	396
17.3.3	Failure Mode and Effect Analysis	398
17.3.4	Quality Function Deployment	398
<b>18</b>	<b>Physical Distribution &amp; Supply Chain Management,</b> by <i>Giuseppe Stabilini</i>	403
18.1	Physical distribution: balancing service level and logistics cost	403
18.2	The characteristics of the context and the design of the distribution network	405
18.3	Polarization choices of logistics distribution	407
18.4	Logistics and manufacturing speculation or postponement	410
18.5	Supply Chain Management	414
18.6	The Bullwhip Effect and Supply Chain Management	415
18.7	Collaborative practices to integrate the supply chain	421
18.8	Collaborative planning	423
18.9	Vendor Managed Inventory	425
18.10	Consignment Stock	429
18.11	Continuous Replenishment Program	431
18.12	Collaborative Planning Forecasting and Replenishment	432

<b>19</b>	<b>Information Systems and Operations Management, by <i>Raffaele Secchi</i></b>	435
19.1	Introduction	435
19.2	Enterprise Resource Planning systems	435
19.3	Advanced planning systems	437
19.3.1	Demand planning	438
19.3.2	Master planning	439
19.3.3	Materials Requirements Planning and Production Planning	440
19.3.4	Scheduling	442
19.3.5	Distribution planning	443
19.3.6	Transportation planning	444
19.3.7	Demand fulfillment	444
19.4	Manufacturing Execution Systems (MES)	445
19.5	Adoption of ERP/APS/MES systems: some possible configurations	446
<b>20</b>	<b>Industry 4.0: The Digital Evolution of Operations, by <i>Raffaele Secchi</i></b>	449
20.1	The fourth industrial revolution	449
20.2	The enabling technologies	449
20.2.1	Advanced manufacturing systems	449
20.2.2	Additive manufacturing	450
20.2.3	Augmented and virtual reality	451
20.2.4	Simulation	452
20.2.5	Integration	453
20.2.6	Big data and analytics	453
20.2.7	Other enabling technologies: IoT, cloud, and cybersecurity	454
20.3	Expected impact on industrial processes	455
20.3.1	Use of production assets	456
20.3.2	Productivity of human resources	456
20.3.3	Synchronization of production and logistics activities	457
20.3.4	Reorganization of product development processes	457
20.4	Operations 4.0 and new business models	458
20.5	The three pillars of the digital transformation of operations	459
20.6	The key elements to implement the Industry 4.0 paradigm	460
	<b>References</b>	463
	<b>About the Authors</b>	469