# Contents

Preface xvii  
Guide for the Reader xix  
Acknowledgments xxi  

## I INTRODUCTION  

### 1 Operations Forensics  

#### 1.1 The Three Components of Operations Forensics  
- Operational Indicators  
- Operational Due Diligence  
- Operational Turnaround  

#### 1.2 Operations Forensics as a Perspective  

#### 1.3 Operations Forensics in the Field  
- Analysts  
  
  Goldman Sachs’s Retail Analyst Group  
- Private Equity Firms  
  
  KKR’s Capstone Group  
  Bain Capital  
- Managers and Consultants  

#### 1.4 Takeaways  

#### 1.5 Further Reading  

### 2 What Financial Statements May or May Not Reveal  

#### 2.1 What Financial Statements Reveal  
- Inferring Business Model from Asset Intensity  
  
  Asset-Intensive Business Models  
  Asset-Light Business Models  
- Inferring Product Mix from Days of Inventory  
- Inferring Customer Type from Days of Receivables  

## Acknowledgments

The contents of this document are detailed in the following structure:

### Preface

- xvii

### Guide for the Reader

- xix

### Acknowledgments

- xx1

## I INTRODUCTION

### 1 Operations Forensics

#### 1.1 The Three Components of Operations Forensics

- Operational Indicators
- Operational Due Diligence
- Operational Turnaround

#### 1.2 Operations Forensics as a Perspective

#### 1.3 Operations Forensics in the Field

- Analysts
  
  Goldman Sachs's Retail Analyst Group
- Private Equity Firms
  
  KKR's Capstone Group
  Bain Capital
- Managers and Consultants

#### 1.4 Takeaways

#### 1.5 Further Reading

### 2 What Financial Statements May or May Not Reveal

#### 2.1 What Financial Statements Reveal

- Inferring Business Model from Asset Intensity
  
  Asset-Intensive Business Models
  Asset-Light Business Models
- Inferring Product Mix from Days of Inventory
- Inferring Customer Type from Days of Receivables
## Contents

2.1.4 Inferring the Cash Conversion Cycle from Receivables, Payables, and Inventory 24
2.1.5 Inferring Margin from Inventory Turn and Vice Versa 25
2.1.6 Inferring the Business Mix 26
2.1.7 Exercise: From Financial Statements to Operations 27

2.2 What Financial Statements Do Not Reveal 29
2.2.1 Risks 29
2.2.2 Contingent Claims 29
2.2.3 Covenants and Rights 29
2.2.4 Reserves 29
2.2.5 Intangible Assets 30
2.2.6 Static and Backward-Looking View 30

2.3 When Might Financial Statements Be Less Accurate? 30
2.3.1 Opportunity 30
2.3.2 Means 32
2.3.3 Motive 33

2.4 Takeaways 35

2.5 Survey of Prior Research in One Paragraph 35

2.6 Further Reading 36

II OPERATIONAL INDICATORS 39

3 Indicators of Accounting Performance 41
3.1 Indicators of Current Performance: ROA Trees 41
3.1.1 Principles for Developing ROA Trees 42
   Begin with Industry Language 43
   Use as Many Decompositions for a Measure as Is Useful 43
   Use a Driver for as Many Measures as Is Useful 43
   Exploit Operational Principles in Decomposition 43
   Use Different Trees for Different Roles 44
   Make Explicit Both Current and Full Potential 44
   Make Intangibles Explicit 44
3.1.2 ROA Tree for Airlines 45
   Major Operational Indicators of ROA Performance 45
   Case: Southwest Airlines 47
   Non-US Airlines 49
3.2 Indicators of Future Performance 51
3.2.1 Advanced Topic: Predicting Sales, Earnings, and Margins Using Inventory Information—the Bernard-Noel Model 52
3.2.2 Predicting Unit Costs Using the Experience Curve 56
III OPERATIONAL DUE DILIGENCE 93

7 The Many Facets of Due Diligence 95
7.1 Why Do We Do Due Diligence? 95
7.2 What Should Due Diligence Seek? 97
   7.2.1 Operational Metrics That Drive Financial Measures 98
   7.2.2 Operational Metrics That Address Strategic Concerns 98
   7.2.3 Operational Metrics to Deduce Other Metrics 100
7.3 When Should It Be Done? 101
7.4 How and By Whom? 103
7.5 Takeaways and Toolkit 105
7.6 Survey of Prior Research in One Paragraph 106
7.7 Further Reading 107

8 Assessing the Customer Base 109
8.1 How Much of Customer Valuation Is Revealed in Financial Statements? 109
   8.1.1 How Much of Customer Valuation Is Revealed in Satisfaction Surveys? 110
8.2 Measuring Customer Profitability 110
8.3 Impact of Customer Defections on Valuation 113
   8.3.1 Advanced Topic: Can Reducing Defection Really Double NPV? 115
8.4 Impact of Channel Mix on Valuation 117
   8.4.1 Advanced Topic: Does Web Use Really Improve Profitability and Retention? 118
8.5 Takeaways and Toolkit 120
8.6 Survey of Prior Research in One Paragraph 121
8.7 Further Reading 122

9 Assessing Lean Management 123
9.1 How Much of Process Performance Is Revealed in Financial Statements? 123
9.2 The Toyota Production System (TPS) 124
   9.2.1 Limits and Limitations of the TPS 126
9.3 Should a Company Implement Lean Management? 127
   9.3.1 Are Lean Management Outcomes Aligned with Strategy? 128
   9.3.2 Does Lean Management Work in the Company's Setting? 128
9.4 Verifying a Company's Lean Management Implementation 129
   9.4.1 Data Envelopment Analysis 129
   9.4.2 Qualitative Verification of Leanness 133
9.5 Takeaways and Toolkit 134
## 10 Assessing Risks

### 10.1 Why Is Risk Assessment Difficult? 138

### 10.2 Systematic Risk 139

### 10.3 Total Risk 141

#### 10.3.1 Probability 141

#### 10.3.2 Severity 143

#### 10.3.3 A Typology of Risk Management Methods 144

#### 10.3.4 Risk Management with a Risk Map 145

#### 10.3.5 Advanced Topic: Process Risks 146

- One Station
- Sequential Stations in a Process
- Pooled Stations in a Process
- Risk of Inadequate Warranty Reserves

#### 10.3.6 One-off Risks and Value at Risk (VaR) 152

- Parametric Method
- Historical Method
- Monte Carlo Method
- Comparison and Critique

### 10.4 Takeaways and Toolkit 157

### 10.5 Survey of Prior Research in One Paragraph 157

### 10.6 Further Reading 158

## 11 Assessing Options

### 11.1 Refresher on Valuing Financial Options 162

### 11.2 Real versus Financial Options 163

### 11.3 Options to Start or Expand Later 164

#### 11.3.1 Binomial Method Using Replication 165

#### 11.3.2 Advanced Topic: Binomial Method Using Risk-Neutral Probabilities 166

#### 11.3.3 Binomial Method in Continuous Time 166

#### 11.3.4 Black-Scholes Method 167

#### 11.3.5 Black-Scholes with Deteriorating Assets 168

#### 11.3.6 Example: Accurate Response at Sport Obermeyer 168

#### 11.3.7 Detecting an Option to Start or Expand Later 168

- Much Learning over Time
- The "Ticket to Play" Is Needed Early

### 11.4 Option to End or Shrink Earlier 169

#### 11.4.1 Example: Staging in Due Diligence and Investing 172

---

### Contents

- 9.6 Survey of Prior Research in One Paragraph 135
- 9.7 Further Reading 135

## 10 Assessing Risks

- 10.1 Why Is Risk Assessment Difficult? 138
- 10.2 Systematic Risk 139
- 10.3 Total Risk 141
  - 10.3.1 Probability 141
  - 10.3.2 Severity 143
  - 10.3.3 A Typology of Risk Management Methods 144
  - 10.3.4 Risk Management with a Risk Map 145
  - 10.3.5 Advanced Topic: Process Risks 146
    - One Station
    - Sequential Stations in a Process
    - Pooled Stations in a Process
    - Risk of Inadequate Warranty Reserves
  - 10.3.6 One-off Risks and Value at Risk (VaR) 152
    - Parametric Method
    - Historical Method
    - Monte Carlo Method
    - Comparison and Critique

## 11 Assessing Options

- 11.1 Refresher on Valuing Financial Options 162
- 11.2 Real versus Financial Options 163
- 11.3 Options to Start or Expand Later 164
  - 11.3.1 Binomial Method Using Replication 165
  - 11.3.2 Advanced Topic: Binomial Method Using Risk-Neutral Probabilities 166
  - 11.3.3 Binomial Method in Continuous Time 166
  - 11.3.4 Black-Scholes Method 167
  - 11.3.5 Black-Scholes with Deteriorating Assets 168
  - 11.3.6 Example: Accurate Response at Sport Obermeyer 168
  - 11.3.7 Detecting an Option to Start or Expand Later 168
    - Much Learning over Time
    - The "Ticket to Play" Is Needed Early

## Further Reading

- 11.4 Option to End or Shrink Earlier 169
  - 11.4.1 Example: Staging in Due Diligence and Investing 172
11.4.2 Detecting an Option to End or Shrink Earlier 172
Some Branches Produce Negative NPV 172
Viable Release Clause 172
11.5 Option in Being Flexible 173
11.5.1 Example: Delayed Differentiation 177
11.5.2 Detecting an Option for Being Flexible 177
Multiple Types of Outcomes 177
Imperfectly Correlated Outcomes 177
Similarly Sized Outcomes 178
11.6 Takeaways and Toolkit 178
11.7 Survey of Prior Research in One Paragraph 178
11.8 Further Reading 179

IV OPERATIONAL TURNAROUNDS 181

12 Turning Around Purchasing 183
12.1 Caveats about Rationalization 183
12.1.1 Balancing Short- and Long-Term Impact 183
12.1.2 Prioritizing Opportunities 184
12.1.3 Accounting for Human Considerations 184
12.2 Rationalize Supplier Base 184
12.2.1 Competition versus Commitment 185
12.2.2 Homogeneity versus Diversity 185
12.2.3 Hungry Newbies versus Strong Incumbents 185
12.3 Design for Supply 186
12.3.1 Architect the Right Supply Chain 186
12.3.2 Consider a Full Range of Possible Supplier Roles 188
12.3.3 Outsource or Offshore with Differentiated Capacities 188
12.3.4 Standardize and Modularize Product Requirements 189
12.4 Reconfigure Sourcing Contracts 189
12.5 Reengineer Purchasing Process 194
12.5.1 Design End-to-End Processes, Eliminate Handoffs 194
12.5.2 Balance the Load 194
12.5.3 Differentiate versus Standardize 194
12.5.4 Automate 194
12.5.5 Centralize versus Decentralize 195
12.6 Takeaways 196
12.7 Survey of Prior Research in One Paragraph 196
12.8 Further Reading 196
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.1</td>
<td>Ensuring Process-Product Fit</td>
<td>199</td>
</tr>
<tr>
<td>13.2</td>
<td>Building Forecasting Capability with a Consensus Approach</td>
<td>199</td>
</tr>
<tr>
<td>13.3.1</td>
<td>Rationalizing Production Assets with Newsvendor Analysis</td>
<td>200</td>
</tr>
<tr>
<td>13.3.2</td>
<td>Additional Rationalization with Pooling</td>
<td>201</td>
</tr>
<tr>
<td>13.3.3</td>
<td>Even Smarter Rationalization with Chaining</td>
<td>202</td>
</tr>
<tr>
<td>13.4</td>
<td>Rationalizing Service Assets with Queueing Analysis</td>
<td>203</td>
</tr>
<tr>
<td>13.4.1</td>
<td>When Customers Cannot Wait</td>
<td>204</td>
</tr>
<tr>
<td>13.4.2</td>
<td>When Customers Wait</td>
<td>205</td>
</tr>
<tr>
<td>13.5</td>
<td>Rationalizing Capacities with Competitive Capacity Analysis</td>
<td>206</td>
</tr>
<tr>
<td>13.6</td>
<td>Driving Down Unit Costs with Experience Curves</td>
<td>209</td>
</tr>
<tr>
<td>13.6.1</td>
<td>Competitive Dynamics</td>
<td>210</td>
</tr>
<tr>
<td>13.6.3</td>
<td>Caveats</td>
<td>213</td>
</tr>
<tr>
<td>13.7</td>
<td>Takeaways</td>
<td>213</td>
</tr>
<tr>
<td>13.8</td>
<td>Survey of Prior Research in One Paragraph</td>
<td>214</td>
</tr>
<tr>
<td>13.9</td>
<td>Further Reading</td>
<td>214</td>
</tr>
<tr>
<td>14</td>
<td>Determining the Right Set of Channels with the Rangan-Zoltners-Becker Model</td>
<td>217</td>
</tr>
<tr>
<td>14.1.1</td>
<td>Embellishments</td>
<td>218</td>
</tr>
<tr>
<td>14.2</td>
<td>Matching Customers with Channels</td>
<td>222</td>
</tr>
<tr>
<td>14.3</td>
<td>Rationalizing the Delivery Architecture</td>
<td>223</td>
</tr>
<tr>
<td>14.4</td>
<td>Takeaways</td>
<td>224</td>
</tr>
<tr>
<td>14.5</td>
<td>Survey of Prior Research in One Paragraph</td>
<td>225</td>
</tr>
<tr>
<td>14.6</td>
<td>Further Reading</td>
<td>225</td>
</tr>
<tr>
<td>15</td>
<td>Operational and Organizational Turnarounds</td>
<td>227</td>
</tr>
<tr>
<td>15.1</td>
<td>Quality Management</td>
<td>227</td>
</tr>
<tr>
<td>15.2.1</td>
<td>Value-Maximizing Output Control</td>
<td>229</td>
</tr>
<tr>
<td>15.2.2</td>
<td>Advanced Topic: Value-Maximizing Process Control</td>
<td>230</td>
</tr>
<tr>
<td>15.3</td>
<td>Innovation Management</td>
<td>235</td>
</tr>
<tr>
<td>15.3.1</td>
<td>Selecting Projects to Pursue: The LPTU Model</td>
<td>236</td>
</tr>
<tr>
<td>15.3.2</td>
<td>Developing Products: The Terwiesch-Xu Model</td>
<td>237</td>
</tr>
<tr>
<td>15.3.3</td>
<td>Advanced Topic: Commercializing Products: The Cohen-Eliashberg-Ho Model</td>
<td>240</td>
</tr>
<tr>
<td>15.4</td>
<td>Revenue Management</td>
<td>242</td>
</tr>
<tr>
<td>15.4.1</td>
<td>Value-Maximizing Allocation of Capacity to Product Tiers</td>
<td>242</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>15.4.2 Value-Maximizing Amount of Overbooking</td>
<td>243</td>
<td></td>
</tr>
<tr>
<td>15.4.3 Advanced Topic: The Pricing of Warranties</td>
<td>244</td>
<td></td>
</tr>
<tr>
<td>15.5 Performance Management</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td>15.5.1 The Gonik Incentive Scheme</td>
<td>248</td>
<td></td>
</tr>
<tr>
<td>15.5.2 Time Equations and the Process Audit</td>
<td>249</td>
<td></td>
</tr>
<tr>
<td>15.5.3 The Balanced Scorecard</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>15.6 Investor Management</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>15.6.1 Tailoring Management by Investor Segment</td>
<td>252</td>
<td></td>
</tr>
<tr>
<td>15.6.2 Some Operationally Related Investor Relations Initiatives</td>
<td>254</td>
<td></td>
</tr>
<tr>
<td>15.7 Takeaways</td>
<td>255</td>
<td></td>
</tr>
<tr>
<td>15.8 Survey of Prior Research in One Paragraph</td>
<td>255</td>
<td></td>
</tr>
<tr>
<td>15.9 Further Reading</td>
<td>256</td>
<td></td>
</tr>
<tr>
<td>Appendix A Industry ROA Trees</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>A.1 ROA Tree for Retail Banking</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>A.1.1 Pricing Deposits and Loans with Interbank Cost and Price of Funds</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>A.1.2 FDIC Assessments and Regulatory Capital</td>
<td>261</td>
<td></td>
</tr>
<tr>
<td>A.1.3 Efficiency Ratio and Branch Network Size</td>
<td>261</td>
<td></td>
</tr>
<tr>
<td>A.2 ROA Tree for a Restaurant</td>
<td>262</td>
<td></td>
</tr>
<tr>
<td>A.2.1 Revenues: Dupes with Coupons and Covers with Differing Tops</td>
<td>262</td>
<td></td>
</tr>
<tr>
<td>A.2.2 FOH Expenses: Comps, Food Costs, and Labor</td>
<td>264</td>
<td></td>
</tr>
<tr>
<td>A.2.3 BOH Expenses: The Brigade, Dead Food, and Vendor Credits and Mispicks</td>
<td>265</td>
<td></td>
</tr>
<tr>
<td>A.2.4 Assets: Liquor Licenses, PPE, WIP, and Par Level</td>
<td>265</td>
<td></td>
</tr>
<tr>
<td>A.3 ROA Tree for Gaming</td>
<td>266</td>
<td></td>
</tr>
<tr>
<td>A.3.1 Win, Drop, Hold Ratio, and the House Advantage</td>
<td>266</td>
<td></td>
</tr>
<tr>
<td>A.3.2 Croupier Rakeoffs</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>A.3.3 Comps Expense and Credit Losses</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>A.3.4 Labor Expenses: Dealer Leverage and Utilization</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>A.4 ROA Tree for Home Building</td>
<td>268</td>
<td></td>
</tr>
<tr>
<td>A.4.1 Backlogs, Cancellation Rate, and Mortgage Capture Rate</td>
<td>269</td>
<td></td>
</tr>
<tr>
<td>A.4.2 Lot Banks and Options</td>
<td>269</td>
<td></td>
</tr>
<tr>
<td>A.5 ROA Tree for Hotel Groups</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>A.5.1 Occupancy Rate</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>A.5.2 Rack Rates and Discounts</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>A.6 ROA Tree for Healthcare</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>A.6.1 Outcomes: Service, Clinical, and Process</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>A.6.2 Length of Stay: The Demand and Supply Views</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>A.7 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.1 Book-to-Bill Ratio and Backlogged Orders</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.2 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.3 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.4 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.5 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
<tr>
<td>A.7.6 ROA Tree for the Semiconductor Industry</td>
<td>274</td>
<td></td>
</tr>
</tbody>
</table>
Contents

A.8 ROA Tree for Oil Exploration and Development 275
   A.8.1 Netback, FDA, and the Recycle Ratio 277
   A.8.2 Reserves and Decline Rate 277
A.9 ROA Tree for Retailing 277
   A.9.1 Same-Store Sales Growth 279
   A.9.2 Sales Conversion 280
   A.9.3 Space Utilization 281
A.10 ROA Tree for Telecom 282
   A.10.1 ARPU, MOU, POP, and Churn 282
   A.10.2 SAC, SDC, and Depreciation Charges 283
A.11 ROA Tree for Life Insurance 284
A.12 ROA Tree for Securities Brokerage 285
A.13 ROA Tree for Pharmaceuticals 287
   A.13.1 Risks in the Path from R&D to IND Status 289
   A.13.2 Manufacturing Expenses: APIs and Excipients 290
A.14 Further Reading 290

Appendix B Resources 291
B.1 Sample Due Diligence Checklists 291
B.2 Books 292
   B.2.1 Operations Management 292
   B.2.2 Private Equity, Finance, Accounting 292
   B.2.3 Econometrics and Analytics 292
B.3 Journals, Magazines, Academic Research 293
B.4 Consultants and Information Sources 293
B.5 Directories, Trade Associations, Standards 294
B.6 Software 295
B.7 Others 295

Appendix C Glossary 297
Notes 301
Index 305