

REINVENTING THE ENERGY VALUE CHAIN

SUPPLY CHAIN ROADMAPS FOR DIGITAL OILFIELDS
THROUGH HYDROGEN FUEL CELLS

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PENNWELL BOOKS

Contents

Figures and Tables	xvii
Dedication	xxi
Foreword	xxiii
Acknowledgments	xxvii
Acronyms and Abbreviations	xxix
Preface	xxxiii
Purpose, Scope, and Development of this Book	xxxix
How the Book Is Organized	xlii
Introduction	xlvii
Cleaner, Greener, and Smarter	xlvii
The Big Shift	xlvii
Supply Chain Types	xlviii
Supply Chain Value Creation Strategies	l
Roadmaps for Maximum Value Creation and Financial Impact	lvii
Supply Chain Cost	lix
Supply Chain Performance Management—Metrics and Targets	lxi
Supply Chain Governance	lxiv
Supply Chain Processes	lxvi
First Principles for Supply Chain Design and Improvement	lxviii
Supply Chain Successes	lxxiii
Conclusion to the Introduction	lxxvii
Methods for CapEx Project Supply Chain Risk Mitigation	1
Chapter Highlights	1
Introduction	3
General Approaches to Managing Risk	3
Value Chain—Specific Risks and Trade-offs	6
Techniques for Capital Project Management Decisions	8
Technology Choice Risk Management	11
Capital Project Risks and Mitigation	14
Build-Own-Operate Choices (BTO, BOOT, etc.)	14
Sustainability Trade-offs	15
Materials and Services Unavailability Risks and Mitigation Strategies	16

- Outsourcing Risks and Mitigation 19
- Supplier Partnering Risks and Mitigation 21
 - Structuring Strategic Partner Relationships 23
- Procurement Bundling Trade-offs 27
- Contract Term Risk and Mitigation 29
 - Determining the Optimal Term of Commitment 29
- Methods for Operations and Maintenance Management Optimization 33**
 - Chapter Highlights..... 33
 - Introduction 34
 - Trade-offs and Management Techniques in Operations & Maintenance..... 34
 - Internet of Things (IoT) and Artificial Intelligence (AI) Technology
 - Choices 37
 - Cybersecurity Risk Management 38
 - Peak Capacity Strategies 39
 - Overall Equipment Effectiveness (OEE)
 - and Return on Net Assets (ROA)..... 39
 - Total Productive Maintenance and Related Concepts..... 41
 - Constraints Management, Debottlenecking, and Flexible Capacity 42
 - Standardization 43
 - Achieving Continuous Cost Reduction..... 45
 - Stochastic Inventory Management 45
 - Vendor Managed Inventory 48
 - JIT 49
 - Transportation and Warehousing Optimization 51
 - Sourcing Trade-offs 52
 - Category Management 52
 - Category Strategies 52
 - Determining the Optimal Number of Suppliers 54
 - Prequalifying Suppliers 58
 - Managing the Tendering Process..... 64
 - Assuring Local Content Where Needed..... 67
 - Total Cost of Ownership (TCO) Trade-offs 70
 - Total Cost of Ownership..... 70
 - Combined Purchase and Operating/Maintenance Agreements 71
 - Health, Safety, & Environmental (HSE) Considerations..... 74
 - Upstream HSE Management 74
 - Downstream HSE Management..... 76
 - Power Industry HSE Management 77
 - Root Cause Analysis 78
 - Failure Mode Effect Analysis 79
 - Selected International Risk Management Standards..... 80
 - The Supply Chain’s Role in Reducing Environmental Footprint..... 85

Hydrogen/Fuel Cells	89
Chapter Highlights	89
Introduction	90
Trade-offs and Management Techniques in Capital Project Management	94
Technology Choice Risk Management: Choosing the Right Fuel	
Cell Chemistry	94
Capital Project Risks and Mitigation:	
Managing an Early-Stage Demonstration Project In-House	95
Supply Unavailability Risks and Mitigation: Ensuring	
an Adequate Source of Platinum	95
Outsourcing Risks and Mitigation: Forming an R&D Partnership	
for Lab Experimentation	96
Supplier Partnering Risks and Mitigation: Licensing Technology	
from a Vendor	96
Procurement Bundling Trade-offs: Negotiating a Package Deal	
Including Customized Development through O&M and Servicing	97
Contract Term Risk and Mitigation: Working with Short-Term	
Agreements Until Requirements and Technologies Stabilize	97
Trade-offs and Management Techniques in Operations & Maintenance	98
Cybersecurity Risk Management: Protecting the FCCU	98
Internet of Things (IoT) and Artificial Intelligence (AI)	
Technology Choices: Piloting AI Technology in Autonomous	
Vehicle Applications	98
Peak Capacity Strategies: Achieving Economies of Scale	
to Gain Effective Capacity	99
Sourcing Trade-offs: Avoiding Intellectual Property Disputes	
in Fuel Cell Supply Agreements	99
TCO Trade-offs: Making (or Spending) Money in Recycling	
and Refurbishing	100
Supply Chain Roadmap for Fuel Cells	100
 Utility-Scale Energy Storage	 103
Chapter Highlights	103
Introduction	104
Trade-offs and Management Techniques in Capital Project Management	109
Technology Choice Risk Management: Minimizing Thermal Risks	
in Batteries	109
Capital Project Risks and Mitigation: Insuring System Performance	
Reliability	110
Supply Unavailability Risks and Mitigation: Securing the Battery	
Raw Materials Supply Chain	110
Outsourcing Risks and Mitigation: Licensing Strategies	111
Supplier Partnering Risks and Mitigation:	
Crafting Flexible Partnerships	112

Procurement Bundling Trade-offs: Architecting a Supply Chain
of Specialists 112

Contract Term Risk and Mitigation: Matching Contract Term
to the Product Roadmap 112

Trade-offs and Management Techniques in Operations & Maintenance. 113

Cybersecurity Risk Management: Reducing the Attack Surface 113

Internet of Things (IoT) and Artificial Intelligence (AI)
Technology Choices: Learning from Demand Fluctuations 113

Peak Capacity Strategies: Optimizing Reliability with Control Systems 114

Sourcing Trade-offs: Ensuring Responsible Sourcing of Cobalt
and Other Minerals 114

TCO Trade-offs: Understanding the Levelized Cost of Storage. 115

Supply Chain Roadmap for Energy Storage 116

Wind 119

Chapter Highlights. 119

Introduction 120

Trade-offs and Management Techniques in Capital Project Management 122

Technology Choice Risk Management: Avoiding Wrong Technology
Choices in Today’s Rapidly Changing Wind Power Landscape 122

Capital Project Risks and Mitigation: Hedging Against Financial Risks 123

Supply Unavailability Risks and Mitigation: Finding Alternative Sources
of Balsa Wood for Blades 124

Outsourcing Risks and Mitigation: Dealing with an Increasingly
Experienced and Competent Market of O&M Vendors 124

Supplier Partnering Risks and Mitigation: Extending a Turbine
Manufacturer Relationship 125

Procurement Bundling Trade-offs: Bundling Turbine Acquisition
and Service Agreement 125

Contract Term Risk and Mitigation: Using Real Options to Achieve Low
Cost with Flexibility. 125

Trade-offs and Management Techniques in Operations & Maintenance. 126

Cybersecurity Risk Management: Treating Cybersecurity
as a Major Part of O&M Expense. 126

Internet of Things (IoT) and Artificial Intelligence (AI)
Technology Choices: Real-Time Automated Bidding Based
on Market Price Patterns. 127

Peak Capacity Strategies: Using Dedicated Production Capacity
to Guarantee Delivery Dates. 127

Sourcing Trade-offs: Building Local Value Chains in the Normal Course
of Business. 128

TCO Trade-offs: Planning for End of Life and Disposal
of Turbine Blades 129

Supply Chain Roadmap for Wind Power. 129

Solar	131
Chapter Highlights.....	131
Introduction	132
Trade-offs and Management Techniques in Capital Project Management	134
Technology Choice Risk Management: PV, Storage, Distributed, CSP, and Floating	134
Capital Project Risks and Mitigation: Setting the Scope of EPCI Services.....	139
Supply Unavailability Risks and Mitigation: Securing Polysilicon	139
Outsourcing Risks and Mitigation: Focusing on Systems or Modules	140
Supplier Partnering Risks and Mitigation: Using Auctions and Competitive Bids.....	140
Procurement Bundling Trade-offs: Coordinating EPC with Project Funding	141
Contract Term Risk and Mitigation: Coping with Tariff and Regulatory Interference	142
Trade-offs and Management Techniques in Operations & Maintenance....	143
Cybersecurity Risk Management: Assessing Firewall Adequacy	143
Internet of Things (IoT) and Artificial Intelligence (AI) Technology Choices: Using Smart Tracking.....	144
Capacity Strategies: Using Solar + Storage to Tame the Duck Curve	144
Sourcing Trade-offs: Identifying Alternative Sources for Competition and Supply Assurance	146
TCO Trade-offs: Avoiding, Replacing, and Disposing of PV Modules	147
Supply Chain Roadmap for Solar Power	148
 Biomass	 151
Chapter Highlights.....	151
Introduction	152
Trade-offs and Management Techniques in Capital Project Management	153
Technology Choice Risk Management: Assessing Multiple Process Routes including “Power to Gas”	153
Capital Project Risks and Mitigation: Choosing an EPC with Depth in the Target Process Route.....	154
Supply Unavailability Risks and Mitigation: Assessing Fuel Supply, Logistics, and Seasonality	155
Outsourcing Risks and Mitigation: Monitoring the Quality and Purity of Incoming Feedstock.....	155
Supplier Partnering Risks and Mitigation: Engineering Design and Operating Parameters	155
Procurement Bundling Trade-offs: Tapping a Leading EPC Firm to Ensure Overall System Compatibility	155

- Contract Term Risk and Mitigation: Aligning Operating and Maintenance Agreements, PPA, and Boiler Longevity 156
- Trade-offs and Management Techniques in Operations & Maintenance. 156
- Cybersecurity Risk Management: Ensuring Reasonable Barriers to Hacking. 156
- Internet of Things (IoT) and Artificial Intelligence (AI)
 - Technology Choices: Establishing a Data Historian to Enable Potential Data Mining for Process Efficiencies 157
- Peak Capacity Strategies: Designing Inbound Logistics Capacity to Match Plant Size 157
- Sourcing Trade-offs: Allowing for High and Potentially Growing Transportation Cost Despite Low-Cost Feedstock 157
- TCO Trade-offs: Conducting Scenario Analysis to Determine the Optimal Feedstock and Process Route 158
- Supply Chain Roadmap for Biomass Power 158

- Oil & Gas—Upstream. 161**
 - Chapter Highlights. 161
 - Introduction: Upstream Supply Chain Characteristics and Cost Drivers. 162
 - Trade-offs and Management Techniques in Capital Project Management 166
 - Technology Choice Risk Management: Carbon Capture & Sequestration, Enhanced Oil Recovery, and More. 166
 - Capital Project Management Structure Choices: Sharing Financial and Operational Risks in Upstream Projects 170
 - Sustainability Trade-offs: Reducing Upstream Emissions. 172
 - Supply Unavailability Risks and Mitigation: Contracting & Procurement Strategies 175
 - Outsourcing Risks and Mitigation: Separating Strategic from Transactional. 177
 - Partnershiping: Single, Dual, and Local Sourcing 179
 - Procurement Bundling: Solutioning, Should-Cost, and Tier-Skipping. 182
 - Contract Term Risk Management: Achieving Economies of Scale through Contract Extensions 189
- Trade-offs and Management Techniques in Operations & Maintenance Management 189
- Internet of Things (IoT) and Artificial Intelligence (AI)
 - Technology Choices: Digitalizing Intelligent Oilfields. 189
- Cybersecurity: Bridging the IT/OT Gap. 191
- Peak Capacity Management Strategies: Optimizing Production, Inventory, and Asset Control 191
- Sourcing Trade-offs: Managing Distributors and Integrators 194
- TCO Trade-offs: Including Throughput in “Total Cost”. 194
- HSE Considerations: Using Remote Controls and Robotics for Improved Safety 195
- Supply Chain Roadmap for Upstream Oil & Gas 195

Oil & Gas—Midstream	197
Chapter Highlights	197
Introduction—Supply Chain Economic Cost Drivers	
and Design Constructs	197
Oil & Gas Pipelines	199
Oil Tankers	201
Liquefied Natural Gas (LNG) Infrastructure and Shipping	202
Tradeoffs and Management Techniques in Capital Project Management ...	203
Technology Choice Risk Management: Selecting a SCADA System	204
Capital Project Risk Mitigation: Standardizing Materials	
and Modularizing Facility Design	205
Sustainability Trade-offs: Preventing & Controlling Pipeline Leaks	208
Supply Unavailability Risks and Mitigation: Planning for Pipe,	
Compressors, and Other Long Lead Time Equipment	208
Outsourcing Risks and Mitigation: Focusing on the Core Midstream	
Business	209
Supplier Partnering Risks: Maintaining Flexibility in LNG Supply Chain	
Infrastructure Commitments	209
Procurement Bundling Tradeoffs: Contracting for Process Control	
and Metering Systems	209
Contract Term Risk and Mitigation: Calibrating Term with Stability	
and Liquidity	210
Tradeoffs and Management Techniques in Operations & Maintenance	
Management	210
Internet of Things (IoT) and Artificial Intelligence (AI)	
Technology Choices: Automating Batch Scheduling & Dispatch	210
Cybersecurity Risk Management: Protecting Flow Control Systems	211
Peak Capacity Strategies: Managing Interruptions & Disruptions	212
Sourcing Tradeoffs: Owning versus Leasing Vessels	212
TCO Tradeoffs: Getting More Performance from Compression Systems ...	213
HSE Considerations: Conforming to Regulatory Standards and Laws	213
Supply Chain Roadmap for Midstream Oil & Gas	213
 Oil & Gas—Downstream	 217
Chapter Highlights	217
Introduction—Supply Chain Economic Cost Drivers	217
Trade-offs and Management Techniques in Capital Project Management ...	220
Technology Choice Risk Management: Digitalizing Process	
Control Systems	220
Capital Project Management Risk Mitigation: Contracting	
and Managing Construction Schedules	221
Sustainability Trade-offs: Moving Toward Desulfurization	
and Ethanol Blends	222

- Supply Unavailability Risks and Mitigation: Managing Shutdowns
and Restarts Through the Extended Supply Chain 222
- Outsourcing Risks and Mitigation: Hiring Safety and Process Auditors. 223
- Supplier Partnering Risks and Mitigation: Negotiating
with Retail Channel Partners 223
- Procurement Bundling Trade-offs: Consolidating Procurement Volumes. . . 223
- Contract Term Risk and Mitigation: Contracting for Oversized Cargo
Shipments 224
- Trade-offs and Management Techniques in Operations & Maintenance
Management 224
- Internet of Things (IoT) and Artificial Intelligence (AI) Technology Choices:
Optimizing Production and Predictive Maintenance Processes 224
- Cybersecurity Risk Management: Assessing Vulnerability Throughout
the Plant 225
- Capacity Strategies: Single- and Multi-Echelon Production Planning 226
- Sourcing Trade-offs: Procuring Site Security Systems & Solutions. 228
- TCO Trade-offs: Moving to Predictive Maintenance for Rotating
Equipment. 228
- HSE Considerations: Ensuring Supply Chain Safety During Shutdowns
and Restarts 229
- Supply Chain Roadmap for Downstream Oil & Gas. 229
- Geothermal. 231**
- Chapter Highlights. 231
- Introduction 231
- Trade-offs and Management Techniques in Capital Project Management . . . 233
- Technology Choice Risk Management: Deciding on Binary, Flash, or Both . . . 233
- Capital Project Risks and Mitigation: Lowering Financial Exposure
Through Feed-In Tariffs and PPAs. 234
- Supply Unavailability Risks and Mitigation: Avoiding Steel Supply
Bottlenecks 234
- Outsourcing Risks and Mitigation: Avoiding Drilling Contractor Delays . . . 235
- Supplier Partnering Risks and Mitigation: Realizing Synergies Across
Geothermal and Other Power Projects 235
- Procurement Bundling Trade-offs: Leveraging EPC Expertise from OEMs . . . 235
- Contract Term Risk and Mitigation: Planning for Generations 236
- Trade-offs and Management Techniques in Operations & Maintenance. . . 236
- Cybersecurity Risk Management: Ensuring Security
of Automation Controllers 236
- Internet of Things (IoT) and Artificial Intelligence (AI) Technology
Choices: Predicting Maintenance Requirements to Reduce Repairs. 237
- Peak Capacity Strategies: Adding Energy Storage and District Heating
to Geothermal Power Generation 238

Sourcing Trade-offs: Building Local Skills Alongside Geothermal Power Capacity	238
TCO Trade-offs: Reducing Lifetime Cost in the Capital Construction Phase	239
Supply Chain Roadmap for Geothermal Power	239
Gas- and Coal-Fired Power	241
Chapter Highlights	241
Introduction—Supply Chain Cost Drivers and Design Constructs	242
Trade-offs and Management Techniques in Capital Project Management	245
Technology Choice Risk Management: Determining the Optimal Power Portfolio with Simulation Tools	245
Capital Project Risks and Mitigation: Using Bid Bonds, Performance Bonds, and Payment Bonds in Construction Contracts	246
Sustainability Trade-offs: Evaluating Fuel-Switching, Co-Firing, and Hybrid Fuels	247
Supply Unavailability Risks and Mitigation: Estimating Delivery Time of Turbines and Generators	248
Outsourcing Risks and Mitigation: Qualifying Suppliers for Major and Minor Component Contracts	248
Supplier Partnering Risks and Mitigation: Communicating with Leading Equipment Suppliers as Partners	248
Procurement Bundling Trade-offs: Deciding When to Use an EPCM Contractor	249
Contract Term Risk and Mitigation: Extending the Length of Long-Term Contracts	249
Trade-offs and Management Techniques in Operations & Maintenance	250
Cybersecurity Risk Management: Adhering to and Benefiting from Power Industry Cybersecurity Standards	250
Internet of Things (IoT) and Artificial Intelligence (AI) Technology Choices: Reliability Engineering and Predictive Maintenance	250
Peak Capacity Strategies: Variable and Digital Power Generation Scheduling and Inventory Planning	252
Sourcing Trade-offs: Integrating Purchase and Operating Agreements	254
TCO Trade-offs: Standardizing Equipment	254
HSE Considerations: Taking Advantage of External Resources and Specialists	255
Supply Chain Roadmap for Gas- and Coal-Fired Power	255
Hydropower	259
Chapter Highlights	259
Introduction	260
Trade-offs and Management Techniques in Capital Project Management	262

- Technology Choice Risk Management: Engineering Hydropower
 - for Declining Water Availability 262
- Capital Project Risks and Mitigation: Mitigating Ecological Risks
 - and Impacts. 263
- Supply Unavailability Risks and Mitigation: Waiting
 - for the Dam Cement 264
- Outsourcing Risks and Mitigation: Securing Performance Guarantees
 - from O&M Subcontractors. 264
- Supplier Partnering Risks and Mitigation: Working
 - with International EPC Firms. 265
- Procurement Bundling Trade-offs: Assembling a Consortium of OEMs,
 - Engineering Firms, and Local Construction Capability 265
- Contract Term Risk and Mitigation: Using Contract Renewal Options 266
- Trade-offs and Management Techniques in Operations & Maintenance. . . . 267
- Cybersecurity Risk Management: Using Unidirectional Gateways 267
- Internet of Things (IoT) and Artificial Intelligence (AI) Technology Choices:
 - Using Sensors to Detect Turbine Noise 267
- Peak Capacity Strategies: Storing Energy with Pumped Hydropower. 268
- Sourcing Trade-offs: Hiring Local Equipment and Services. 268
- TCO Trade-offs: Refurbishing Turbines and Generators 269
- Supply Chain Roadmap for Hydropower 269
- Nuclear** 271
 - Chapter Highlights. 271
 - Introduction 272
 - Trade-offs and Management Techniques in Capital Project
 - Management 274
 - Technology Choice Risk Management: Designing Uniquely Different Value
 - Chains for Small, Large, or Floating Plants 274
 - Capital Project Risks and Mitigation: Managing the “Capital Project Supply
 - Chain” 275
 - Sustainability Trade-offs: Transporting Small Amounts of Potent Fuel
 - in Accordance with Defined Protocols 276
 - Supply Unavailability Risks and Mitigation: Planning Access
 - to Processed Uranium 277
 - Outsourcing Risks and Mitigation: Containing Risk
 - by Minimizing Outsourcing 277
 - Supplier Partnering Risks and Mitigation: Forming Strong Alliances
 - with Experienced Nuclear Plant Engineering and Construction Firms. . . . 278
 - Procurement Bundling Trade-offs: Bundling O&M Services to Minimize
 - Interfaces and Handoffs. 278
 - Contract Term Risk and Mitigation: Contracting for Fuel in Increments
 - of Five Years 278

Trade-offs and Management Techniques in Operations & Maintenance. 279

 Cybersecurity Risk Management: Protecting the Reactor from Determined
 Hackers 279

 Internet of Things (IoT) and Artificial Intelligence (AI) Technology Choices:
 Developing Digital Twins and Mining Operational Data 279

 Peak Capacity Strategies: Shutting Down and Restarting for Fueling
 and Maintenance 280

 Sourcing Trade-offs: Being Willing to Pay Extra for Safety. 281

 TCO Trade-offs: Extending MTBR with Smart Maintenance 281

 Supply Chain Roadmap for Nuclear Power. 281

Conclusion 285

Appendix 1

Bullwhip in the Oil and Gas Supply Chain: The Cost of Volatility 291

 Filling an Important Research Gap. 291

 Evidence of the Bullwhip Effect. 292

 The Cost to E&P Companies, Refiners, OEMs, and Component Suppliers. 294

 Suggestions for Further Research: How to Mitigate the Costs of Bullwhip 297

Appendix 2

Common Categories of Externally Purchased Equipment and Services 299

Appendix 3

Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) 309

Glossary of Terms, Acronyms, and Abbreviations 313

Bibliography 325

References 333

Index 371

About the Authors 389

Other Supply Chain Books by David Steven Jacoby 390

Cover Legend 391

Figures and Tables

Figure 1. Evolution of Growth in Oil, Gas, and Power Markets	xxxiv
Figure 2. Annual Capital Expenditure by Energy Technology	xxxvii
Figure 3. Illustrative Capital Project Sizes for Various Energy Technologies	xxxviii
Figure 4. Value Chain versus Supply Chain.	xli
Figure 5. Supply Chain Types.	xlix
Figure 6. Correlation between Supply Chain Type and Supply Chain Strategy	li
Figure 7. Conventional Energy Supply Chain Strategy Profile	liii
Figure 8. Renewable Energy Supply Chain Strategy Profile.	liv
Figure 9. Supply Chain Value Frontiers for Coal and Gas-Fired versus Solar Power	lvi
Figure 10. Prevalent Supply Chain Strategy Positioning of Energy Companies	lix
Figure 11. Supply Chain Intensity of Energy Technologies.	lx
Figure 12. Supply Chain Rationalization Levers Based on “Should-Cost”.	lxii
Figure 13. Quantification of Value Chain Strategy Benefits	lxiii
Figure 14. Quantification of Supply Chain Risks.	lxiii
Figure 15. Illustrative Organization of Oil & Gas Company Operations Management Activities.	lxv
Figure 16. Managed Spend per Supply Management Employee	lxvi
Figure 17. Typical Multi-Industry Supply Chain Management Processes.	lxvii
Figure 18. System Dynamics Model of a Four-Tiered Upstream Oil & Gas Supply Chain.	lxx
Figure 19. A Typical Oil & Gas Production Project Framework Divided into Stages & Gates	lxxii
Figure 20. Typical Project Time Frame for an LNG Export Facility	lxxiii
Figure 21. General Strategies for Managing Risk.	3
Figure 22. Boston Strategies International’s Framework for Supply Chain Market Intelligence	6
Figure 23. Trade-offs and Management Techniques in Capital Project Management.	9
Figure 24. Illustrative Reduction in Cost per Unit over Time.	12
Figure 25. Repair and Maintenance Costs as a Function of New Model Introduction Year.	12
Figure 26. Illustrative Economic Impact of Technology Factors over Time	13
Figure 27. Typical Assignment of Risks Assumed by EPC Contractors Under Five Types of Agreement	15
Figure 28. Fluctuation of Metals Prices During the Commodity Supercycle	18

Figure 29. Outsourcing Decision Process 21

Figure 30. US Manufacturing Prices—The Long View 22

Figure 31. The Value Creation Triangle 23

Figure 32. The Partnership Ladder 24

Figure 33. Partnership Maturity Model 25

Figure 34. Trade-offs and Management Techniques in Operations & Maintenance Management 35

Figure 35. Traditional “Push” vs. Just-in-Time Paradigms 50

Figure 36. Correlation between Industry Concentration and Price Inflation for 58 Oil & Gas Supply Markets 55

Figure 37. How to Decide Whether to Single or Dual Source 57

Figure 38. Simplified Representation of a Supplier Qualification Process 59

Figure 39. Range of Lead Times from Different Suppliers for the Same Product at the Same Time 60

Figure 40. Evolution and Status of Local Content Regulations in Six Countries . . . 68

Figure 41. Supply Chain Risks for 15 Countries 69

Figure 42. Life cycle Cost Components 72

Figure 43. Root Cause Analysis Applied to Supply Chain Risk 79

Figure 44. Summary of Risk Management Tools 82

Figure 45. Utility-Scale Hydrogen Fuel Cell Power Generation Value Chain (Hypothetical) 92

Figure 46. Emerging Supply Chain Opportunities for Fuel Cells 102

Figure 47. Energy Storage Applications 105

Figure 48. Selected Utility-Scale Energy Storage Technologies by Power Rating and Discharge Time 106

Figure 49. Lithium-Ion Battery Energy Storage Value Chain (Illustrative) 108

Figure 50. Emerging Supply Chain Opportunities for Energy Storage 117

Figure 51. Global Investment in Wind and Solar Power 121

Figure 52. Wind Power Value Chain (Illustrative) 121

Figure 53. Emerging Supply Chain Opportunities for Wind Power 130

Figure 54. Utility-Scale Solar Photovoltaic Power Plant Value Chain (Illustrative) 133

Figure 55. The Duck Curve 145

Figure 56. Emerging Supply Chain Opportunities for Solar Power 150

Figure 57. Value Chain for Biomass Power Generation (Illustrative) 153

Figure 58. Emerging Supply Chain Opportunities in Biomass Power Generation 159

Figure 59. Oil & Gas Value Chain 163

Figure 60. Upstream Oil & Gas Value Chain (Illustrative)..... 164

Figure 61. Decision Flowchart for Taking Options on Land..... 169

Figure 62. Jackup and Deepwater Floater Rig Economies of Scale 185

Figure 63. “Should-Cost” Waterfall Chart..... 188

Figure 64. Emerging Supply Chain Opportunities in Upstream Oil & Gas..... 196

Figure 65. Midstream Oil & Gas Value Chain from an Offshore Production Platform (Illustrative) 198

Figure 66. Eurasian Gas Pipeline Network 200

Figure 67. World Tanker Fleet by Class..... 201

Figure 68. Analysis of Strategic Investment in an FGSO Hub Using Real Options 205

Figure 69. Results of Real Options Analysis on an FGSO Hub..... 206

Figure 70. Emerging Supply Chain Opportunities for Midstream Oil & Gas... 215

Figure 71. Downstream Petroleum Value Chain (Illustrative) 219

Figure 72. Emerging Supply Chain Opportunities in Downstream Oil & Gas... 230

Figure 73. Geothermal Power Value Chain (Illustrative)..... 233

Figure 74. Emerging Supply Chain Opportunities for Geothermal Power 240

Figure 75. Gas- and Coal-Fired Power Value Chain 243

Figure 76. Complex Interrelationships Between Power Capital Project Decisions..... 244

Figure 77. Pareto Chart of Causes of Boiler Failure 251

Figure 78. Emerging Supply Chain Opportunities for Gas- and Coal-Fired Power..... 257

Figure 79. Hydropower Value Chain (Illustrative)..... 260

Figure 80. Emerging Supply Chain Opportunities in Hydropower..... 270

Figure 81. Nuclear Power Value Chain (Illustrative)..... 274

Figure 82. Emerging Supply Chain Opportunities for Nuclear Power 283

Figure 83. Evidence of Bullwhip Effect in the Oil & Gas Equipment Industry .. 293

Figure 84. Demand Volatility of Motor, Generator, and Turbine Sales..... 294

Figure 85. Supply Chain Simulation Architecture..... 295

Figure 86. Oil Price in the Volatile Oil Price Scenario 295

Figure 87. Cumulative Cost of Supply in the Volatile Oil Price Scenario..... 297

use a large vehicle fleet to move it around. Therefore, infrastructure projects that allow them to reduce inventory, transportation costs, or fleet assets will have a big impact. Discrete manufacturers are the most common type of manufacturer.

4. Design-to-Order Manufacturing. Design-to-order manufacturers do not ship product until it has been ordered, and usually ship directly to customers. They are usually engineering intensive and hold low inventory.
5. Distribution. Distributors buy finished product, usually add value to it, and resell it. Their profit depends on their ability to move product quickly and reliably. Unique transportation or logistics capabilities allow them to create supply chain advantages.
6. Reselling. Resellers, for example retailers and e-retailers, buy finished product and resell it in its identical state. They spend relatively large amounts on transportation, largely because their retail outlets and/or their customers are widely dispersed. Their success usually depends on excellent inventory management and close collaboration with the end customer.

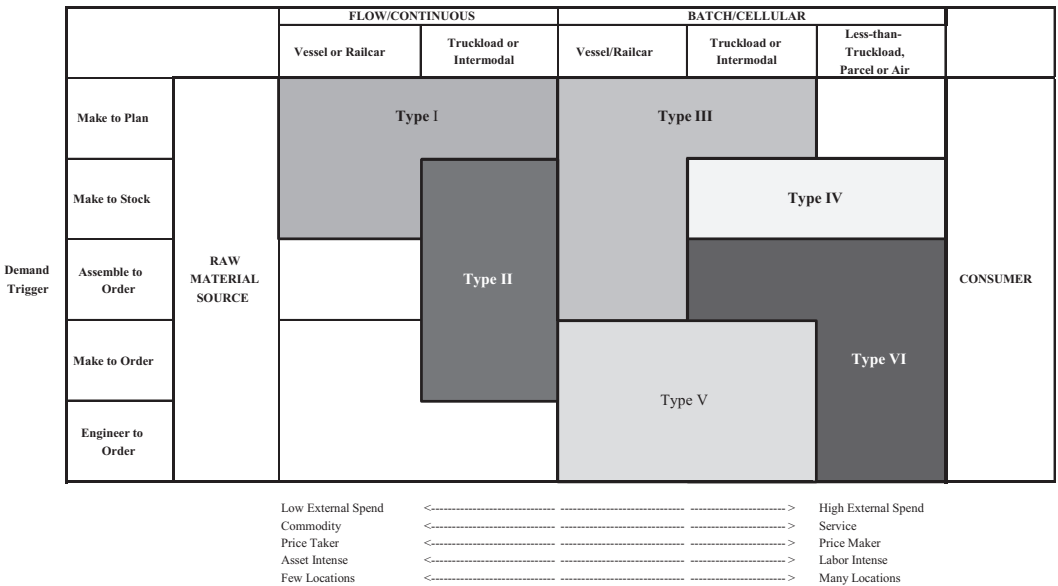


Figure 5. Supply Chain Types

(Source: Jacoby, David Steven, in *Guide to Quantifying the Economic Impacts of Federal Investments in Large-Scale Freight Transportation Projects*. Prepared for: Office of the Secretary of Transportation, US Department of Transportation, by: Cambridge Systematics, Inc., Economic Development Research Group, Inc., and Boston Logistics Group, Inc., August 2006. Page A-11)

Supply Chain Performance Management— Metrics and Targets

Executive management at most companies expects the supply chain management function to reduce cost and increase net margin and return on assets, and to improve operations, especially to increase quality and availability of raw materials, intermediate services, and finished product. However, the same tools can in many cases be used to optimize around other objectives (for example, environment or local content).

Rationalization efforts have been demonstrated to create at least a 13% improvement in net margin.¹¹ *Synchronization* efforts have been shown to create a 10% improvement on Return on Net Assets (RONA). Supply chain initiatives in the *synchronization* phase often achieve the improvement in RONA by reducing forecast error, and thus achieving level production both within the enterprise and across trading partners, which decreases the need for inventory and fixed assets.

Most often, improvements are measured at the project level, where they are sought in targeted areas that contribute to a higher net margin and a higher return on assets such as:

- Reduced upfront purchase cost. Lower upfront cost is the most intuitive savings framework. However, it can be complicated by tiered pricing, promotions, discounts, and volume rebates.
- Reduced operating cost. Energy savings is a common way to reduce operating costs. Operating assumption variables can affect the savings, especially for large turbines and electrical distribution and control equipment.
- Increased throughput, or productivity. Improvements that increase the speed of a process such as drilling or refinery expansions can lead to higher production overall. Savings for these types of improvements can be calculated on the basis of either cost savings or profit enhancement. Cost savings might be estimated by, say, the reduction in the number of rig-days needed to drill a well. The savings per well then can be multiplied by the number of rigs in operation and the number of wells that need to be drilled over a period of time. If the increased productivity leads to reduced time to first production, the benefit may be improved profitability. To quantify this benefit, take the number of extra days of production and calculated additional profit based on a typical well, then apply an average output price per unit to get the profit margin, and multiply the resulting benefit by the number of units producing.
- Shorter lead times for the delivery of equipment or services. For capital items, one might determine that order lead times are constraining production that would otherwise be occurring. In this case, the decrease

¹¹ Based on a prototypical operation

Introduction

Large capital projects are characterized by risk-reward trade-offs such as market (price and volume) risk, materials supply risk, supplier risk, construction risk (sometimes offloaded to an EPC firm), and operational, supplier, technology, political, and regulatory risk.⁴³

Capital project managers can seek market risk analysis from a number of specialist consulting firms; political and regulatory risk are special types that extend well beyond supply chain management. These are not covered here.

General Approaches to Managing Risk

Supply chain policies, processes, systems, and organizational structures can be used to avoid, diversify, minimize, or hedge risk (see Figure 21). While the bulk of this chapter will provide tools and techniques for managing each of the eight trade-offs cited above, a general framework for managing risk can guide and inform some of the more detailed tools and techniques.

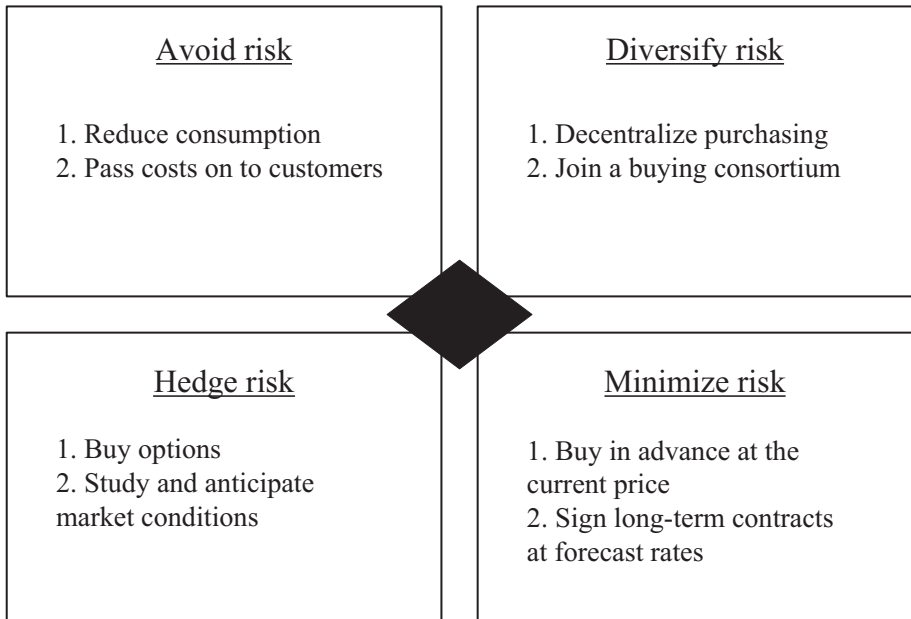


Figure 21. General Strategies for Managing Risk

(Source: Boston Strategies International)

The easiest and in many cases the most effective risk management strategy is to avoid risk entirely by passing it through to customers.

Fence, during which manufacturing assets can be redeployed. If planners wait until the Manufacturing Time Fence (line scheduling), there is a much greater chance of material or component unavailability or high prices. Stretching from a shorter to a longer time horizon allows more flexibility to pursue alternative strategies if there are any available.

Acquire the source. If material shortage appears to be chronic, it may make sense to acquire the source. Vertical integration makes sense when the cost of acquiring the materials through external sources exceeds the cost of procuring them internally.⁵⁶ Even if they could be procured at lower unit prices on the outside, the cost of searching for sources of supply and negotiating prices, and arranging logistics, transportation, and payment may be complicated in a tight market, and if sustained for long periods might justify vertical integration.

Refurbish, recycle, or renew. Over the last five years refurbishment has become a fairly popular alternative to buying new for a variety of equipment. Refurbished equipment is often less expensive and can have a shorter lead time, especially if the supplier builds refurbished equipment to stock. Recycling component materials has also become more prevalent, as evidenced by the introduction of new recovery processes for rare earth metals on the part of refinery catalyst manufacturers. For example, Grace Davison installed metal traps on its catalyst production lines, which recover about 2% of the total rare earth metal volume used to make the catalysts.⁵⁷ Using a larger analogy, enhanced oil recovery (EOR) is a large-scale analogy to the refurbishment concept: depletion has reached the point where recovery processes are widespread.

Outsourcing Risks and Mitigation

The decision about whether to insource or outsource an activity (“make vs. buy,” as it is commonly called) drives cost in the same way as the ownership control decision discussed immediately above.

In addition, deciding to rent vs. buy can similarly change the risk/return profile of a work process by outsourcing part or all of it. Outsourcing affects not only risk profile, but also cost, effectiveness, and sustainability. Potential reasons for outsourcing may include:

- Lower cost and capital requirements. For instance, one production chemical supplier does not make any chemicals. It buys the base chemicals, mixes them, and resells them to the oil producer or service company. This allows the supplier to avoid tying up capital in facilities and gives it the flexibility to choose the best supplier for a given type of chemical without developing the chemistry itself.

8. Require vendors to use strong authentication and cryptographic methods
9. Require vendors to manage credentials stringently, including periodic deprovisioning
10. Require vendors to deny communications with risky profiles and log denied access incidents
11. Use intelligence about active and potential threat sources to mitigate active threats
12. Require vendors to establish a documented patch process with safeguards against malicious actors
13. Verify patch authenticity via cryptography, hashes, certificates, or two-factor authentication

For further information on cybersecurity measures, readers may refer to the guidelines prepared by the Critical Infrastructure Protection Committee of the North American Electric Reliability Council, including provenance guidelines prepared by a working committee chaired by David Steven Jacoby.⁷⁶

Peak Capacity Strategies

Overall Equipment Effectiveness (OEE) and Return on Net Assets (ROA)

The Overall Equipment Effectiveness (OEE) framework measures asset effectiveness by defining three types of capacity:

- Rated capacity (as determined by the original equipment manufacturer)
- Standard capacity (driven by equipment availability, which is based on scheduled uptime vs. total available time). Most often, this corresponds to the operator's normative, or expected output.
- Demonstrated capacity (actual production vs. the standard), which is affected by product quality or yield (good output vs. total output)

Actual capacity is equal to rated capacity times standard uptime times efficiency, or put another way, $\text{Time Available} \times \text{Utilization} \times \text{Efficiency}$, where $\text{Utilization} = [\text{Actual hours worked} / \text{Standard hours available}]$ and $\text{Efficiency} = [\text{Standard hours produced} / \text{Actual hours worked}]$.

The best performers have an OEE averaging 90%, whereas laggards have an OEE averaging 74%, according to a study by Aberdeen Group. The differences are due to:

- 2% unscheduled asset downtime vs. 12% unscheduled asset downtime
- 12% reduction in maintenance cost vs. 2% increase in maintenance cost
- 24% improvement in ROA vs. plan, compared to a 5% decrease in ROA vs. plan⁷⁷