

Seventh Edition

SUPPLY CHAIN MANAGEMENT

STRATEGY, PLANNING, AND OPERATION

Sunil Chopra

Kellogg School of Management



New York, NY

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Dedication

I would like to thank my colleagues at Kellogg for all I have learned from them about logistics and supply chain management. I thank Peter Meindl for his collaboration during earlier editions of this book. I am grateful for the love and encouragement that my parents, Krishan and Pushpa, and sisters, Sudha and Swati, have always provided during every endeavor in my life. I thank my children, Ravi and Rajiv, for the joy they have brought me. Finally, none of this would have been possible without the constant love, caring, and support of my wife, Maria Cristina.

—Sunil Chopra

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PREFACE

This book is targeted toward an academic as well as a practitioner audience. On the academic side, it is appropriate for MBA students, engineering master's students, and senior undergraduate students interested in supply chain management and logistics. It can also serve as a suitable reference for both concepts as well as providing a methodology for practitioners in consulting and industry.

NEW TO THIS EDITION

The seventh edition has focused on changes that enhance students' ability to sharpen their critical thinking and data analytics skills as they study with the book. All concepts discussed in the book are linked to strategic decision making in a supply chain, and all quantitative ideas are illustrated using spreadsheets that can be implemented in practice. Some specific changes in the seventh edition include:

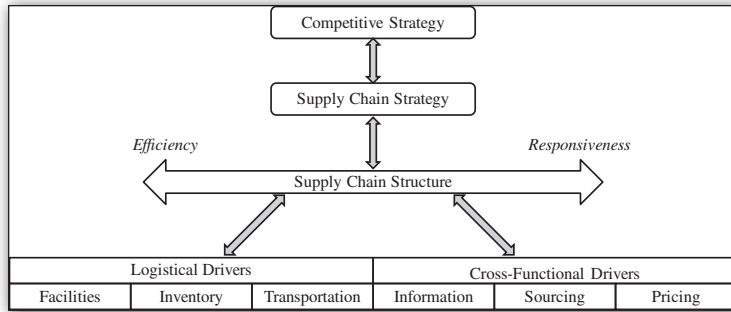
- The link between supply chain decisions and the financial performance of a firm is developed in detail in Chapter 3.
- The concepts underlying the design of distribution networks are illustrated in the context of omni-channel retailing in Chapter 4. The evolution of retailing is used throughout the book to illustrate the link between supply chain concepts and strategic decision making in a supply chain.
- Each section of each chapter in the book is associated with a clearly identified learning objective that is summarized at the end of the section.
- We have added new mini-cases in Chapters 5, 8, and 15. Information in other cases has been updated to be current.
- New exercises have been added in several chapters.
- For all numerical examples discussed in the book, we have developed spreadsheets that students can use to understand the concept at a deeper level. These spreadsheets are referred to in the book and allow the student to try different “what-if” analyses. These spreadsheets are available at www.pearsonhighered.com/chopra along with basic guidance on how they may be created and used.
- We have continued to add current examples throughout the book, with a particular focus on bringing in more global examples.

SOLVING TEACHING AND LEARNING CHALLENGES

To be successful, supply chain practitioners must be able to formulate effective supply chain strategy and be able to solve any resulting supply chain problems using the available analytical tools. In a supply chain class this creates the challenge of teaching students to think strategically while supporting their decisions with robust quantitative analysis. This book is designed to help faculty and students overcome this challenge through its conceptual and pedagogical structure. Conceptually, the book aims to develop an understanding of the following key areas and their interrelationships:

- The strategic role of a supply chain
- The key strategic drivers of supply chain performance
- Analytic methodologies for supply chain analysis

To illustrate the strategic importance of good supply chain management, we provide many current examples to show how companies have succeeded through effective supply chain management or failed because of weak supply chain management. Our strategic framework, the use of Excel-based models to explain analytic methodologies, and several mini-cases to help students internalize the link between the analytic methodologies and strategic decision making provide pedagogical support for faculty using the book.



A Consistent Strategic Framework

Within the strategic framework, we identify facilities, inventory, transportation, information, sourcing, and pricing as the key drivers of supply chain performance. The book is structured to dig deeper into each driver to understand its role in the success of a supply chain, its interaction with other drivers, analytic methodologies to support decisions related to the driver, and managerial levers related to the driver that help improve supply chain performance.

Every analytic methodology is illustrated with its application in Excel. Students have access to the associated Excel file along with instructions to construct and use the file. The Excel files help students deepen their understanding of the link between the analytic models and the strategic decisions they support.

Every analytic methodology is illustrated with its application in Excel. Students have access to the associated Excel file along with instructions to construct and use the file. The Excel files help students deepen their understanding of the link between the analytic models and the strategic decisions they support.

Mini Cases

Most chapters have mini cases that can be used by faculty to ensure that students can apply the concepts and methodologies in the context of strategic decision making for a business.

DEVELOPING CAREER SKILLS

Skills learned in this book will be of great use no matter what path students choose to follow. The book is developed with the premise that good strategic decisions cannot be made without access to relevant analytics, and all analytics should be designed to support decision making. As a result, students will develop critical thinking, the ability to formulate and analyze problems, and support their recommendations with analytics that uses data literacy and computing skills.

- Every chapter in the book pushes students to think critically in order to define and solve supply chain problems. For example, Chapter 4 develops a framework for distribution networks and then pushes students to think about how retailing may evolve in the future as consumer preferences and technology change. The first part of the chapter teaches frameworks and concepts related to the design of distribution networks. The last part of the chapter then pushes the students to analyze retailing by applying the knowledge they have gained in order to decide how retailers need to change in order to succeed in the 21st century.
- All the analytics in the book are developed through the use of Microsoft Excel. This helps students develop data literacy, computing skills, and the knowledge of how to apply information technology to support decision making. The analytics that are developed in these chapters in turn support the framework laid out in Chapter 4. Whereas Chapter 4 helps students to think conceptually about why certain retailing models have succeeded for selling jewelry while others have failed, the succeeding chapters help students quantify financial metrics for different retail networks. As a result, students learn how to use data and models to improve strategic decision making.

	A	B	C	D	E	F	G	H	I	J	
1	Inputs - Costs, Capacities, Demands										
2	Demand Region										
3	Supply Region	Production and Transportation Cost per 1,000,000 Units					Fixed Cost (\$)	Low Capacity	Fixed Cost (\$)	High Capacity	
4	N. America	81	92	101	130	115	6,000	10	9,000	20	
5	S. America	117	77	108	98	100	4,500	10	6,750	20	
6	Europe	102	105	95	119	111	6,500	10	9,750	20	
7	Asia	115	125	90	59	74	4,100	10	6,150	20	
8	Africa	142	100	103	105	71	4,000	10	6,000	20	
9	Demand	12	8	14	16	7					
10											
11	Decision Variables										
12	Demand Region - Production Allocation (Million Units)										
13	Supply Region	N. America	S. America	Europe	Asia	Africa	Plants (1=open)	Plants (1=open)			
14	N. America	0	0	0	0	0	0	0			
15	S. America	0	0	0	0	0	0	0			
16	Europe	0	0	0	0	0	0	0			
17	Asia	0	0	0	0	0	0	0			
18	Africa	0	0	0	0	0	0	0			
19											
20	Constraints										
21	Supply Region	Excess Capacity									
22	N. America	0									
23	S. America	0									
24	Europe	0									
25	Asia	0									
26	Africa	0									
27		N. America	S. America	Europe	Asia	Africa					
28	Unmet Demand	12	8	14	16	7					
29											
30	Objective Function										
31	Cost =	\$ -									

Cell	Cell Formula	Equation	Copied to
B28	=B9 - SUM(B14:B18)	5.1	C28:F28
B22	=G14*H4 + H14*J4 - SUM(B14:F14)	5.2	B23:B26
B31	=SUMPRODUCT(B14:F18,B4:F8) + SUMPRODUCT(G14:G18,G4:G8) + SUMPRODUCT(H14:H18,H4:I8)	Objective Function	—

Excel Based Models

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Part 1 Building a Strategic Framework to Analyze Supply Chains		
Ch. 1: Understanding the Supply Chain	Introduces the supply chain, the managerial objective, and key decisions	
Ch. 2: Achieving Strategic Fit in a Supply Chain	Discusses the need to align strategy with supply chain capabilities	
Ch. 3: Supply Chain Drivers and Metrics	Defines key drivers of supply chain performance and associated performance metrics	
Part 2 Designing the Supply Chain Network		
Ch. 4: Designing Distribution Networks and Applications to Omni-Channel Retailing	Introduces framework for designing distribution networks with an application to omni-channel retailing	
Ch. 5: Network Design in the Supply Chain	Presents analytic models that support network design	
Ch. 6: Designing Global Supply Chain Networks	Discusses risks in global supply chains and analytic methodologies that incorporate uncertainty in network design	
Part 3 Planning and Coordinating Demand and Supply in a Supply Chain		
Ch. 7: Demand Forecasting in a Supply Chain	Introduces techniques for demand forecasting and measuring forecast error	
Ch. 8: Aggregate Planning in a Supply Chain	Introduces methodologies to plan supply to meet seasonal demand	
Ch. 9: Sales and Operations Planning in a Supply Chain	Discusses how optimally managing both demand and supply can grow supply chain profits	
Ch. 10: Coordination in a Supply Chain	Discusses obstacles to coordination and managerial levers that help improve coordination in a supply chain	
Part 4 Planning and Managing Inventories in a Supply Chain		
Ch. 11: Managing Economies of Scale in a Supply Chain – Cycle Inventory	Introduces methodologies to obtain optimal batch sizes and discusses managerial levers that help reduce cycle inventory without hurting costs	
Ch. 12: Managing Uncertainty in a Supply Chain – Safety Inventory	Introduces methodologies to obtain safety inventory and discusses managerial levers that help reduce safety inventory without hurting product availability	
Ch. 13: Linking Product Availability to Profits	Discusses managerial levers that help increase profits in a supply chain	
Part 5 Designing and Planning Transportation Networks		
Ch. 14: Transportation in a Supply Chain	Discusses options and tradeoffs when designing a transportation network	
Part 6 Managing Cross Functional Drivers in a Supply Chain		
Ch. 15: Sourcing Decisions in a Supply Chain	Introduces the concept of total cost in the context of sourcing and discusses the benefits of sharing risk and reward in a supply chain	
Ch. 16: Pricing and Revenue Management in a Supply Chain	Discusses how differential pricing can help increase profits in a supply chain	
Ch. 17: Sustainability and the Supply Chain	Discusses the challenge to sustainability posed by the tragedy of the commons and the role of incentives and regulation for improved sustainability	
Part 7 Online Chapter		
Ch. A: Information Technology in a Supply Chain	Introduces a framework for the role of information technology in a supply chain	

INSTRUCTOR TEACHING RESOURCES

At the Instructor Resource Center, <http://www.pearsonhighered.com/irc>, instructors can easily register to gain access to a variety of instructor resources available with this text in downloadable format. If assistance is needed, our dedicated technical support team is ready to help with the media supplements that accompany this text. Visit <https://support.pearson.com/getsupport> for answers to frequently asked questions and toll-free user support phone numbers.

This program comes with the following teaching resources.

Supplements available to instructors at www.pearsonhighered.com/irc	Features of the Supplement
Instructor's Solution Manual developed by the author	<ul style="list-style-type: none"> • Case Teaching Notes and Worksheets • Spreadsheets for all quantitative examples • Discussion questions • Example figures • Additional exercises • Solutions to all questions and problems in the book
Test Bank authored by Geoff Willis of the University of Central Oklahoma	2000 multiple-choice, true/false, short- answer, and graphing questions with these annotations: <ul style="list-style-type: none"> • Correct answer • Difficulty level (1 for straight recall, 2 for some analysis, 3 for complex analysis) • Learning outcome reference • Topic covered • AACSB learning standard (Analytical Thinking; Information Technology; Application of Knowledge)
TestGen® Computerized Test Bank	TestGen allows instructors to: <ul style="list-style-type: none"> • Customize, save, and generate classroom tests • Edit, add, or delete questions from the Test Item Files • Analyze test results • Organize a database of tests and student results.
PowerPoint Presentations authored by Jeff Heyl of the Lincoln University	Slides include all the graphs, tables, and equations in the textbook. PowerPoints meet accessibility standards for students with disabilities. Features include, but not limited to: <ul style="list-style-type: none"> • Keyboard and Screen Reader access • Alternative text for images • High color contrast between background and foreground colors

For Students

The following material is available to students at <http://www.pearsonhighered.com/chopra>:

- Spreadsheets for numerical examples discussed in the book. These provide the details of the example discussed, but are live and allow the student to try different what-if analyses.
- Spreadsheets that allow students to build every table shown in Chapters 5 through 16.
- Online chapter: Chapter A: Information Technology in a Supply Chain.
- Technical Note: Routing and Scheduling in Transportation. This note is also bundled with the Instructor's Manual available on www.pearsonhighered.com/irc.

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