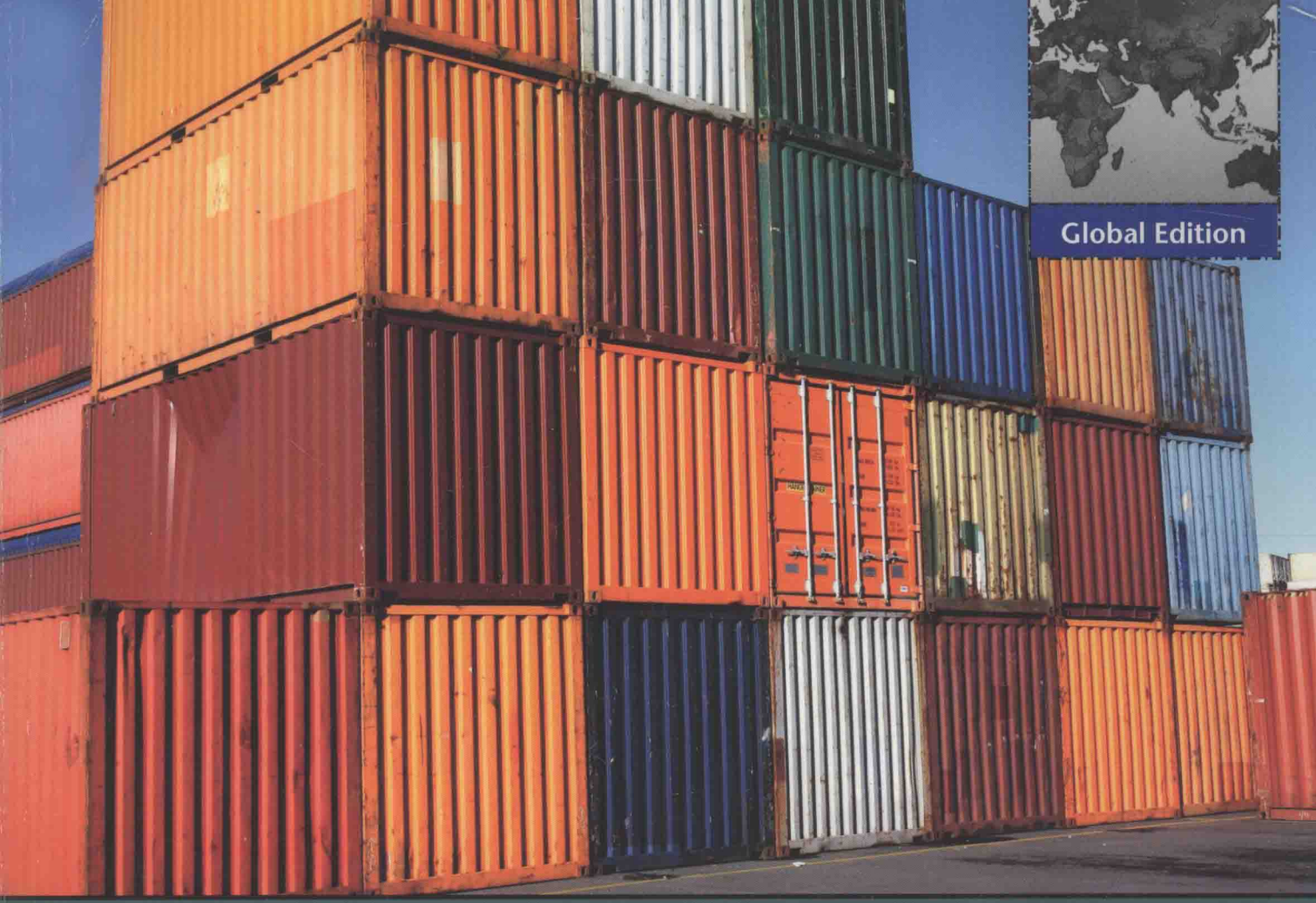

Global Edition

Supply Chain Management

STRATEGY, PLANNING, AND OPERATION

Fourth Edition

Sunil Chopra
Peter Meindl

PEARSON

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SUPPLY CHAIN MANAGEMENT

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Sunil Chopra
Kellogg School of Management
Northwestern University

Peter Meindl
Barclays Global Investors

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Cover Printer: Lehigh-Phoenix Color/Hagerstown
Text Font: 10/12 Times

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10 9 8 7 6 5 4 3 2 1

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ISBN 13: 978-0-13-609451-7
ISBN 10: 0-13-609451-1

Dedication

I would like to thank my colleagues at Kellogg for all that I have learned from them about logistics and supply chain management. I am grateful for the love and encouragement 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

I would like to thank three mentors—Sunil Chopra, Hau Lee, and Gerry Lieberman—who have taught me a great deal. Thank you also to my parents and sister for their love, and to my sons, Jamie and Eric, for making me smile and teaching me what life is truly all about. Most important, I thank my wife, Sarah, who makes life wonderful and whom I love with all of my heart.

—Pete Meindl

ABOUT THE AUTHORS

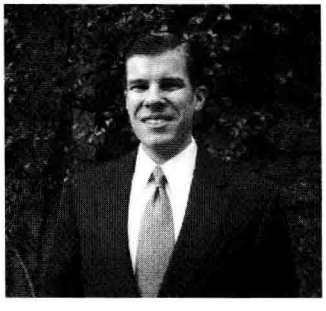
SUNIL CHOPRA

Sunil Chopra is the IBM Distinguished Professor of Operations Management and Information Systems at the Kellogg School of Management. He has served as the Codirector of the Masters of Management and Manufacturing program, a joint dual-degree program between the Kellogg School of Management and the McCormick School of Engineering at Northwestern University. He is currently the Senior Associate Dean for Curriculum & Teaching at Kellogg. He has a PhD in Operations Research from SUNY at Stony Brook. Prior to joining Kellogg, he taught at New York University and spent a year at IBM Research.

Professor Chopra's research and teaching interests are in supply chain and logistics management, operations management, and the design of telecommunication networks. He has won several teaching awards at the MBA and Executive programs of Kellogg. He has authored more than 35 papers and two books.

He has been a Department Editor for *Management Science* and an Associate Editor for *Manufacturing & Service Operations Management*, *Operations Research,* and *Decision Sciences Journal*. His recent research has focused on supply chain risk to understand sources of risk and devise mitigation strategies that buffer risk effectively at low cost. He has also consulted for several firms in the area of supply chain and operations management.

PETER MEINDL



Peter Meindl is a Research Officer with Barclays Global Investors. Previously, he was a consultant with the Boston Consulting Group and Mercer Management Consulting, as well as the director of strategy with i2 Technologies. Pete holds a PhD, MS, BS, and BA from Stanford, as well as an MBA from the Kellogg School at Northwestern.

The first edition of this book won the prestigious Book of the Year award in 2001 from the Institute of Industrial Engineers.

BRIEF CONTENTS

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PREFACE

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

NEW TO THIS EDITION

The fourth edition has focused on building on changes that were incorporated in the third edition. We have also added changes that we believe significantly improve the book.

- Though the impact of globalization in supply chains was discussed in various parts of previous editions, we felt that the topic deserved a dedicated chapter. The new Chapter 6 is focused on the design of global supply chain networks. The chapter starts with a detailed discussion of total cost in the offshoring decision and the importance of risk when designing supply chain networks. This provides a good context for the following discussion on evaluation of supply chain decisions under uncertainty. The BioPharma case at the end of Chapter 6 fits very well with the new positioning of the chapter. The discussion of globalization has also been enhanced in Chapter 14 on sourcing. We have also added global examples throughout the book.
- We view Chapter 4 as one that could be used by an instructor early in the course to motivate the detailed discussion that follows, or at the end of the course to wrap up and bring together all the discussion. At Kellogg we use it at both points in the course. Sections 4.1–4.3 are used early on to motivate the discussion on all the drivers. Section 4.4 is used at the end to bring together many of the concepts discussed in the context of the various firms discussed in Chapter 4.
- In Chapter 17, we have altered the presentation to broaden the focus from the bullwhip effect to lack of coordination. The bullwhip effect is of course one outcome of lack of coordination, but our presentation now tries to make the point that lack of coordination affects incentives, information flow, and product flow, and thus worsens performance in every aspect of a supply chain.
- We have added several examples throughout the book to help increase the variety of contexts in which the concepts are discussed.

For instructors that focus on the more quantitative content of the book, we have made the following changes:

- In Chapter 10 we have added a small section on production lot sizing that describes the model used when a batch is produced at a specified production rate rather than showing up all at once.
- In Chapter 11, we have added an appendix that describes how safety inventory calculations can be made for very slow-moving items with high coefficients of variation where the normal approximation is not very good.
- In Chapter 12, we have enhanced the section on quick response by providing approximation methods that can be used to estimate the impact of increasing the number of replenishment orders in a season. The heuristics provided offer a more tractable approach than simulation, which was presented in previous editions of the book. The heuristics presented use content that has always been provided in Section 12.2 of the book and can easily be evaluated using Excel.

We also heard from several users who did not like the removal of "routing and scheduling" from Chapter 13 in the third edition. Our goal is to make this material available online along with other material that faculty may find useful.

The book has grown from a course on supply chain management taught to second-year MBA students at the Kellogg School of Management at Northwestern University. The goal of this class was to cover not only high-level supply chain strategy and concepts, but also to give students a solid understanding of the analytical tools necessary to solve supply chain problems. With this class goal in mind, our objective was to create a book that would 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

Our first objective in this book is for the reader to learn the strategic importance of good supply chain design, planning, and operation for every firm. The reader will be able to understand how good supply chain management can be a competitive advantage, whereas weaknesses in the supply chain can hurt the performance of a firm. We use many examples to illustrate this idea and develop a framework for supply chain strategy.

Within the strategic framework, we identify facilities, inventory, transportation, information, sourcing, and pricing as the key drivers of supply chain performance. Our second goal in the book is to convey how these drivers may be used on a conceptual and practical level during supply chain design, planning, and operation to improve performance. We have included a case on Seven-Eleven Japan that can be used to illustrate how the company uses various drivers to improve supply chain performance. For each driver of supply chain performance, our goal is to provide readers with practical managerial levers and concepts that may be used to improve supply chain performance.

Utilizing these managerial levers requires knowledge of analytic methodologies for supply chain analysis. Our third goal is to give the reader an understanding of these methodologies. Every methodological discussion is illustrated with its application in Excel. In this discussion, we also stress the managerial context in which the methodology is used and the managerial levers for improvement that it supports.

The strategic frameworks and concepts discussed in the book are tied together through a variety of examples that show how a combination of concepts is needed to achieve significant increases in performance.

FOR INSTRUCTORS

The following supplements are available to adopting instructors.

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