

Third Edition

OPERATIONS

and SUPPLY CHAIN
MANAGEMENT
THE CORE

F. Robert Jacobs
Richard B. Chase

Operations and Supply Chain Management: The Core

third edition

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OPERATIONS AND SUPPLY CHAIN MANAGEMENT: THE CORE

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*To Harriet and the Kids—Laurie,
Andy, Glenn, Rob, Christine, and Eloy
and
To Jennifer and Suzy*

PREFACE

The goal of this book is to provide you with the essential information that every manager needs to know about operations and supply chain-related activities in a firm. Times have changed dramatically over the last few years. Organization structures are now much flatter, and rather than being functionally organized, companies often are organized by customer and product groups. Today's manager cannot ignore how the real work of the organization is done. This book is all about how to get the real work done effectively. It makes little difference if you are officially in finance, marketing, accounting, or operations; The value-added work, the process of creating and delivering products, needs to be completed in a manner that is both high-quality and maximally efficient. Many of the things you do, or will do, in your job are repetitive, even some of the most creative and high-profile activities. You should think of this course as preparing you to be your most productive and helping you help your organization be its most productive.

We can consider the importance of the material in the book on many levels, but let's focus on three. First, consider your role as a business unit manager with people working under your supervision. Next, in the longer term, you probably have aspirations to become a senior executive with responsibility for multiple businesses or products. Finally, you may decide to specialize in operations and supply chain management as a long-term career.

In your role as a manager with people working under your supervision, one of your major duties will be to organize the way work is done. There needs to be some structure to the work process, including how information is captured and analyzed, as well as how decisions and changes and improvements are made. Without a logical or structured approach, even a small group may be subject to errors, inefficiencies, and even chaos.

Designing efficient process flows is an important element of getting a group to work together. If your group is involved in creative activities such as designing cars, buildings, or even stock portfolios, there still needs to be structure to how the work is done, who is responsible for what, and how progress is reported. The concepts of project management, manufacturing and service process design, capacity analysis, and quality in this text are all directly related to the knowledge you will need to be a great supervisor in your organization, and getting your group to work productively and efficiently will lead to success and more responsibility for you.

Next, think about becoming a senior executive. Making acquisitions, planning mergers, and buying and selling divisions will get your name and picture in business magazines. Deals are easily explained to boards, shareholders, and the media. They are newsworthy and offer the prospect of nearly immediate gratification, and being a deal maker is consistent with the image of the modern executive as someone who focuses on grand strategy and leaves operations details to others. Unfortunately, the majority of deals are unsuccessful. The critical element of success, even with the grandest deals, can still be found most often in the operational details.

Real success happens when operational processes can be improved. Productivity improvements from things such as sharing customer service processes, purchasing systems, distribution and manufacturing systems, and other processes can lead to great synergies and success. Operations accounts for 60 to 80 percent of the direct expenses that limit the profit of most firms. Without these operations synergies, designed and implemented by executives with a keen understanding of the concepts in this book, companies are often left with expensive debt, disappointed customers and shareholders, and pressure on the bottom line—on earnings.

Finally, you may be interested in a career in operations and supply chain management. Well, you are not alone. Professional organizations such as the Association for Operations

Management, the Institute for Supply Management, and the Council of Supply Chain Management Professionals have well over 200,000 members participating in regular monthly meetings, annual conferences, and certification programs. Entry-level jobs might be as a forecast strategist, project manager, inventory control manager, production supervisor, purchasing manager, logistics manager, or warehouse specialist. In addition, top operations students may obtain their initial jobs with consulting firms, working as business process analysts and system design specialists.

We encourage you to talk to your instructor about what you want to get out of the course. What are your career aspirations, and how do they relate to the material in this course? Write your instructor a short e-mail describing what you want to do in the future—this is invaluable information for tailoring the material in the course to your needs. As you work through the text, share your experiences and insights with the class. Being an active student is guaranteed to make your experience more valuable and interesting.

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F. Robert Jacobs
Richard B. Chase

A NOTE TO INSTRUCTORS

Operations and Supply Chain Management: The Core derives its title from a combination of ideas and trends. The book is designed to be lean and focused, much in the tradition of the concepts taught in the book. The topics selected are the result of the study of the syllabi of dozens of representative U.S. universities. There are a wide variety of topics covered, many more than could be covered in a single course. Our “big book,” *Operations and Supply Chain Management* is comprehensive and is intended for those that want to pick and choose topics that best fit the objectives of their course. The “Core” book covers the topics that are most commonly included in these courses and has material sufficient for a 12- to 15-week course. The material included in the “Core” is reviewed each year in focus groups and extensive surveys, and based on this feedback the revisions are developed.

As is well known in the field, success for companies today requires successfully managing the entire supply flow, from the sources of the firm, through the value-added processes of the firm, and on to the customers of the firm.

In *Operations and Supply Chain Management: The Core 3e*, we take students to the center of the business and focus on the core concepts and tools needed to ensure that these processes run smoothly.

Discussion of Third Edition Revisions

The revisions to the third edition have been driven by our focus on supply chain analytics. Supply chain analytics involves the analysis of data to better solve business problems. We recognize that this is not really new since data have always been used to solve business problems. But what is new is the reality that there are so much more data now available for decision making.

In the past, most analysis involved the generation of standard and ad hoc reports that summarized the current state of the firm. Software allowed query and “drill down” analysis to the level of the individual transaction, useful features for understanding what happened in the past. Decision making was typically left to the decision maker based on judgment or simple alerting rules. The new “analytics” movement takes this to a new level using statistical analysis, forecasting to extrapolate what to expect in the future, and even optimization, possibly in real time, to support decisions.

In this new edition, our goal is to recapture this spirit of using integrated analytic and strategic criteria in making operations and supply chain decisions. We have done this in two major ways. First, we have reorganized the material in the book by integrating the strategic and analytic material. Next, we have written a series of 11 analytics exercises that are spread through the chapters. Eight of the 11 exercises are totally new in this edition.

These new Analytic Exercises use settings that are modern and familiar to students taking the course. They include Starbucks, cell phones, notebook computers, Taco Bell Restaurant, Toyota, a retail website-based company, and industrial products that are sourced from China/Taiwan and sold globally.

The book has been reorganized into three major sections: Strategy and Analytics; Manufacturing and Service Processes; and Supply Chain Processes and Analytics. Our strategy is to weave analytics into the more managerial material so that the student sees the important role of data analysis in making operations and supply chain management decisions.

In the first section, Strategy and Analytics, we cover forecasting and learning curve analytic tools since forecasting demand and understanding the implications of learning are essential to making good long-term strategy and capacity decisions. Since most strategic plans are implemented using projects, we include this topic in the first section as well. In

the project chapter, we introduce a good amount of material on product design through examples and exercises due to the strategic importance of these projects to the success of the firm.

The second section, Manufacturing and Service Processes gets into the nuts and bolts of operations management. This section is a subset of the material covered in the APICS Certificate in Production and Inventory Management (CPIM) exam. The section introduces the ways that manufacturing and service systems are organized and include neat analytic exercises for assembly line design and queuing. Sales and operations planning and material requirements planning are covered. The quality management and Six Sigma chapter covers topics that would be appropriate for a green-belt program and includes good coverage of the popular value-stream mapping technique.

Finally, the third section, Supply Chain Processes and Analytics, discusses processes that source material for internal operations and then distribute products to the customer. The analytic models involved with independent demand inventory control and location/transportation models are included here. The topics are tied together in the lean supply chain chapter, which now stresses the cost versus disruption risk trade-offs that are involved as such tactics as single sourcing and just-in-time inventory are employed.

The following are a list of the major revisions in each chapter:

- *Chapter 1 Operations and Supply Chain Management*—Here our focus on integrating analytics is introduced in the opening section of the chapter. We have moved and expanded the material on how Wall Street measures efficiency, which was in the strategy chapter, to this chapter. The material has been expanded to show the leveraging impact of a reduction in the cost of raw material on profit and return on investment. An interesting analytic exercise where students must compare similar companies relative to their efficiency is now included in the chapter. A number of other changes have been made to better explain the history of the topic and its tie into employment opportunities.
- *Chapter 2 Strategy and Sustainability*—A new introduction that shows how many companies are expanding their focus beyond just making a profit has been written. We have also now included more examples and explanation of order winning and qualifying criteria to help students better understand these important concepts. A new section on assessing the risk associated with operations and supply chain strategies is now included in the chapter. This includes material on categorizing risk and a risk management process.
- *Chapter 3 Forecasting Demand*—In this chapter, we have a new opening vignette on Starbucks and this is tied to a new analytics exercise at the end of the chapter. The material is fresh and relates to the significant forecasting challenge a growing company like Starbucks has. Based on feedback from reviewers, the material has been reorganized, starting with simpler time series analysis, progressing to linear regression, decomposition of time series, and finally error measurement. Much work has been put into improving the explanations of the models in the chapter, and a new solved problem has been added.
- *Chapter 4 Strategic Capacity Management*—A new and much clearer summary of what strategic capacity planning is has been added to the chapter. The learning curve material has now been taken out of an appendix and moved to an addendum to the chapter.
- *Chapter 5 Projects*—The vignette has been changed and describes the gigantic project in India to create IDs and supporting data from everyone living in India. A new analytics exercise has been written that is much better than the old one. The theme is still cell phone design, but the tasks and the design of the initial network are much

easier to understand. The students are then taken through a series of changes in the project and asked to assess the impact of these changes. The last change involves a complete flipping of the project, where vendors are selected at the beginning and work directly with project teams to complete the project (much like Apple designs the iPhone).

- *Chapter 6 Manufacturing Processes*—The “positioning inventory in the supply chain” (decoupling point) exhibit has been changed to make it easier to understand. Break-even analysis has been removed from the chapter to an addendum to the chapter. This is designed to keep the material included in the chapter more focused while keeping break-even analysis an option for those that want to include it. The explanation of assembly line balancing has been revised. Many new problems were added to this chapter, especially ones that relate to the use of Little’s Law and the analysis of bottlenecks. A completely revised analytics exercise is included that involves the design of a notebook computer assembly line.
- *Chapter 7 Service Processes*—Similar to Chapter 3, here we have tied the opening vignette and analytic exercise together with all new material. The scenario is a Taco Bell drive-thru where the students are asked to analyze the system using queuing models. The problem is set up in a way that is very general and students should be able to see how these models can be applied to many real-world settings. The description of when simulation is appropriate is expanded. Finally, ten new problems have been added to the chapter.
- *Chapter 8 Sales and Operations Planning*—The Bradford Manufacturing case was changed to an analytics exercise.
- *Chapter 9 Material Requirements Planning*—A new opening vignette that shows the bill of materials for the iPad was added to this chapter. This includes data on the cost of the various items needed to build the iPad. The material was sequenced by moving “Where MRP Can Be Used” ahead of “Master Production Scheduling.” This gives a better flow where “Master Production Scheduling” immediately precedes the start of the MRP logic material. Some changes were made to the exhibits to make them easier to understand. A new solved problem was also added to the chapter. Brunswick Motors was converted to an analytics exercise.
- *Chapter 10 Quality Management and Six Sigma*—Information on ISO standards was changed to include ISO 26000, which offers guidance on socially responsible behavior. An all-new analytics exercise was written to replace Hank Kolb. This exercise relates to the issues with which Toyota has dealt with their recent recalls. The first part deals with managerial issues and processes that Toyota has changed in reaction to the problem. The second part is a capability analysis for a part in the accelerator pedal mechanism.
- *Chapter 11 Inventory Management*—A new analytics exercise titled “Inventory Management at Big10Sweaters.com” was added to the chapter. This discusses a new startup company that sells custom sweaters on a website. Decisions related to purchasing the sweaters from an overseas supplier need to be made prior to the start of football season. Ten new problems were added to the chapter.
- *Chapter 12 Lean Supply Chains*—The opening vignette was changed and shows how dramatically inventory has been reduced by companies over the past 20 years. The vignette also describes how this reduction makes companies vulnerable to disruptions in the supply chain. The material on using lean concepts has been revised to now explain how the differences in uncertainty and variability are much more difficult to control in services than they are in manufacturing. The value-stream mapping

material has been streamlined a little. An example of a “freeze window” has been included.

- *Chapter 13 Global Sourcing and Procurement*—The opening vignette has been changed and now shows how difficult it is for suppliers who may be far removed from the actual customer must deal with major swings in demand as the economy ratchets up and down. This is good for getting students thinking about what causes the bullwhip effect. Some additional material has been added to the “Total Cost of Ownership” section that discusses other factors that may need to be considered including exchange rates, risk of doing business in a particular region of the world, and other factors. A new analytics exercise is included in the chapter centered on global sourcing decisions. The case involves the shipping of goods from suppliers in China and Taiwan to a distribution center in the United States. Costs related to the shipping of large and small containers of items, running consolidation centers, and packing efficiency are considered in the case. This exercise and the one used in Chapter 14 tie together.
- *Chapter 14 Location, Logistics, and Distribution*—A new opening vignette that describes the logistics operations of a global cement company has been added. The vignette highlights the impact of logistics on the goals the company has related to sustainability. The use of regression for locating facilities has been revised to make the example more understandable. A new analytics exercise has been added that involves the location of U.S. distribution centers for an industrial supplier. The case is independent of the one in Chapter 13 but involves the same company.

New Pedagogy

- Learning objectives are now included within the chapter.
- Key terms are defined in the margin of the text when they first appear.

TECHNOLOGY

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OPERATIONS MANAGEMENT AND THE AACSB

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Many educational institutions today are focused on the notion of *assurance of learning*, an important element of some accreditation standards. *Operations and Supply Chain Management* is designed specifically to support your assurance of learning initiatives with a simple, yet powerful solution.

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Walkthrough

Major Study and Learning Features

The following section highlights the key features developed to provide you with the best overall text available. We hope these features give you maximum support to learn, understand, and apply operations concepts.

Chapter Opener

