

This International Student Edition is for use outside of the U.S.

Sixth Edition

OPERATIONS AND SUPPLY CHAIN MANAGEMENT

THE CORE

F. Robert Jacobs
Richard B. Chase

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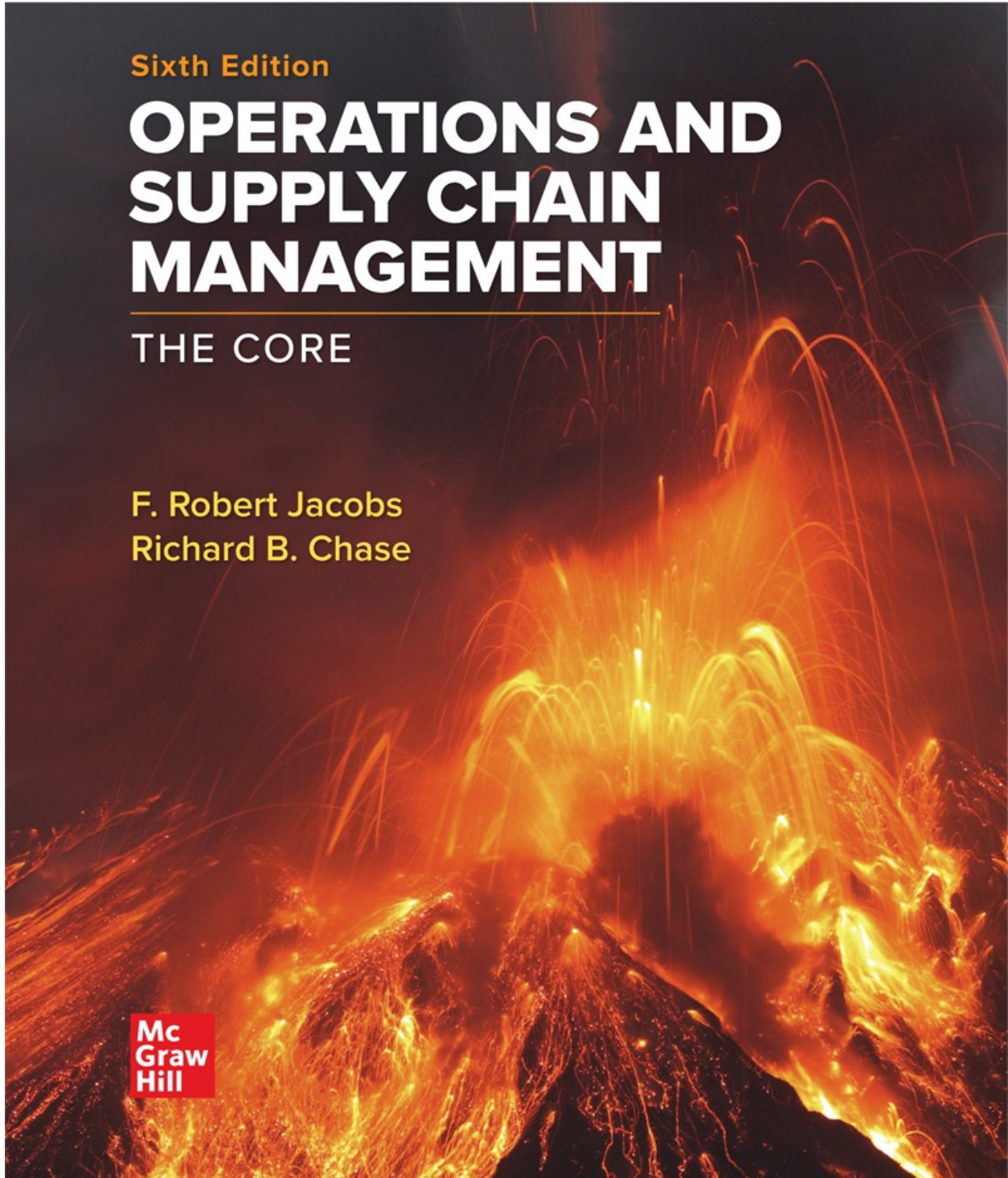
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Operations and Supply Chain Management: The Core

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Operations and Supply Chain Management: The Core

Sixth Edition

F. ROBERT JACOBS

Indiana University

RICHARD B. CHASE

University of Southern California





OPERATIONS AND SUPPLY CHAIN MANAGEMENT

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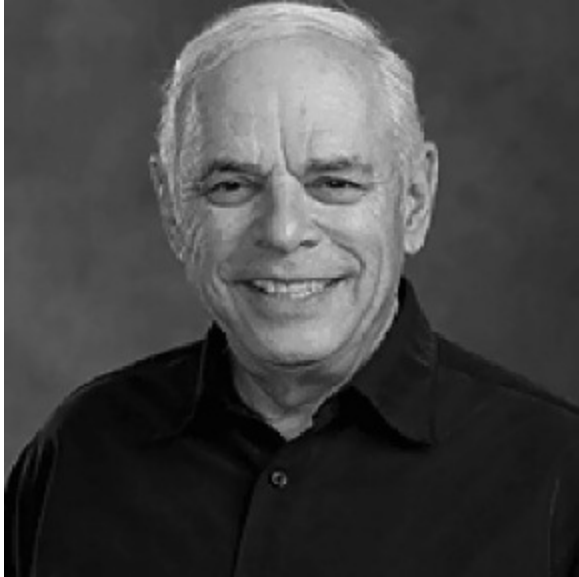
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*To Jenny and
Suzy, this one is
for you.*

ABOUT THE AUTHORS



F. Robert Jacobs is Professor Emeritus of Operations and Decision Technologies at Indiana University. He received a BS in industrial engineering as well as computer and information science, an MBA, and a PhD in operations management all from The Ohio State University. He has also taught at the University of Houston and The Ohio State University. He has published 7 books and over 50 research articles on topics that include enterprise resource planning, inventory control, the design of manufacturing facilities, cellular manufacturing, and the scheduling of manufacturing operations. He is a Fellow of the Decision Sciences Institute and past president and has received teaching honors such as MBA Teaching Award, Students Award for Teaching Excellence in International Business Issues, and Teaching Excellence in Operations Management.



Richard B. Chase is Justin B. Dart Professor Emeritus of Operations Management at the Marshall School of Business, University of Southern California. He received his PhD in operations management, as well as an MBA and BS from UCLA. He has taught at the Harvard Business School, IMD (Switzerland), and the University of Arizona. His research examines service process design and service strategy. In 2006 he received a POMS Lifetime Achievement Award for his research in service operations and in 2004 received a Scholar of the Year Award by the Academy of Management. In 2009, he was honored in the *Production and Operations Management Journal* for his contributions to operations management. He is a Fellow of the Academy of Management, Production Operations Management Society, and the Decision Sciences Institute. He was also an examiner for the Malcolm Baldrige National Quality Award. Dr. Chase has lectured/consulted recently on service and excellence to such organizations as Cisco Systems, Four Seasons Resorts, General Electric, and the Gartner Group.

PREFACE

Just as lava flows from the core of the earth, operations and supply management is the core of business. Materials must flow through supply processes to create cash output and profits.

In Operations and Supply Management: The Core 6e, 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.

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. Things 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 this 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.

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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. 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.

ACKNOWLEDGMENTS

Special thanks to those who develop and market the book: Chuck Synovec, Director; Noelle Bathurst, Portfolio Manager; Harper Christopher, Executive Marketing Manager; Ryan McAndrews, Product Developer; Amy Gehl, Content Project Manager; Vanessa McClune, Assessment Project Manager; and Matt Diamond, Senior Designer. The time spent talking to faculty at the conferences is appreciated. Also, thanks to Gary Black who keeps Connect current.

Thanks also to the many loyal adopters of the book. Special thanks to Jess Rose, a student at Maryville University, who was particularly helpful with input for this edition.

Last, but certainly not least, we thank our families. We have stolen countless hours away for this project; time that would otherwise be spent with them. We sincerely appreciate their support.

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 who want to pick and choose topics that best fit the objectives of their course. The “Core” book covers the topics most commonly included in these courses and has material sufficient for a 12- to 15-week course.

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 6e*, 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 Sixth Edition Revisions

Many of the revisions to the sixth 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. What *is* new is the reality that there are a great deal 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, we now have 15 Analytics Exercises (four new ones). These exercises have proven to be popular in our books. These Analytics Exercises use settings that are modern and familiar to students taking the course. They include Starbucks, cell phones, notebook computers, Tesla, a retail website-based company, a tree farm, and industrial products that are sourced from China/Taiwan and sold globally.

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In Chapter 1, we have added a new exercise titled *The Supply Chain Improvement Model*. Chapter 2 features a new vignette that describes a company started with a special-purpose acquisition company (SPAC) that features a large indoor farm operation. A new carbon footprint exercise has been added to the chapter. In Chapter 3 a new forecasting analytical exercise has been added. Chapter 6 discusses the use of electronic vehicle platforms to make the manufacturing of new cars at Audi and Porsche efficient. A new inventory management exercise has been added to Chapter 11 that relates to running a tree farm. Insights from the recent Covid-19 pandemic have been added throughout the book, together with many other updates.

In this book, all of the chapters have been designed to be independent. We have put much effort into the organization of the book but recognize that our organization might not align with the way you are using the material in your course. In addition, many of you may custom publish a version of the book to exactly meet your needs. The chapters have been designed to allow this type of customization.

The chapters are all now tightly organized by special learning objectives. The learning objectives for the chapter are defined at the start. Special contiguous sections are designed to cover each objective. The chapter summary and discussion and objective questions are also organized by learning objective. This new organization allows material to be assigned at the level of learning objective. If the desire might be to skip some advanced

techniques, for example, this can be done easily by not assigning the specific learning objective. This allows considerable flexibility in how the material is used in a class.

The material has also been adapted to work well with electronic media, since this is now becoming the media of choice at many universities.

TECHNOLOGY

McGraw-Hill Connect Features

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- Test Banks
- Excel Templates

Student Study Center

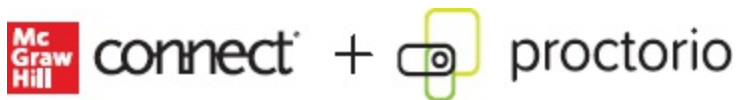
The Connect Student Study Center is the place for students to access additional resources. The Student Study Center offers students quick access to study and review material.

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OPERATIONS MANAGEMENT AND THE AACSB

Assurance of Learning Ready



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.

Each test bank question for *Operations and Supply Chain Management* maps to a specific chapter learning outcome/objective listed in the text. You can use our test bank software, EZ Test and EZ Test Online, or *Connect Operations Management* to easily query for learning outcomes/objectives that directly relate to the learning objectives for your course. You can then use the reporting features of EZ Test to aggregate student results in similar fashion, making the collection, presentation, and assurance of learning data simple and easy.

AACSB Statement



McGraw-Hill Education is a proud corporate member of AACSB International. Understanding the importance and value of AACSB accreditation, *Operations and Supply Chain Management* recognizes the curricula guidelines detailed in the AACSB standards for business accreditation by connecting selected questions in the test bank to the six general knowledge and skill areas in the AACSB standards Assessment of Learning Standards.

The statements contained in *Operations and Supply Chain Management* are provided only as a guide for the users of this textbook. The AACSB leaves content coverage and assessment within the purview of individual schools, the mission of the school, and the faculty. While *Operations and Supply Chain Management* and the teaching package make no claim of any specific AACSB qualification or evaluation, we have within the test bank labeled questions according to the six general knowledge and skill areas.

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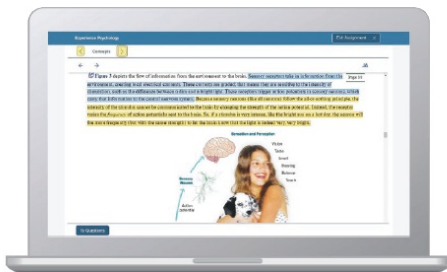
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"I really liked this app—it made it easy to study when you don't have your text-book in front of you."

- Jordan Cunningham,
Eastern Washington University



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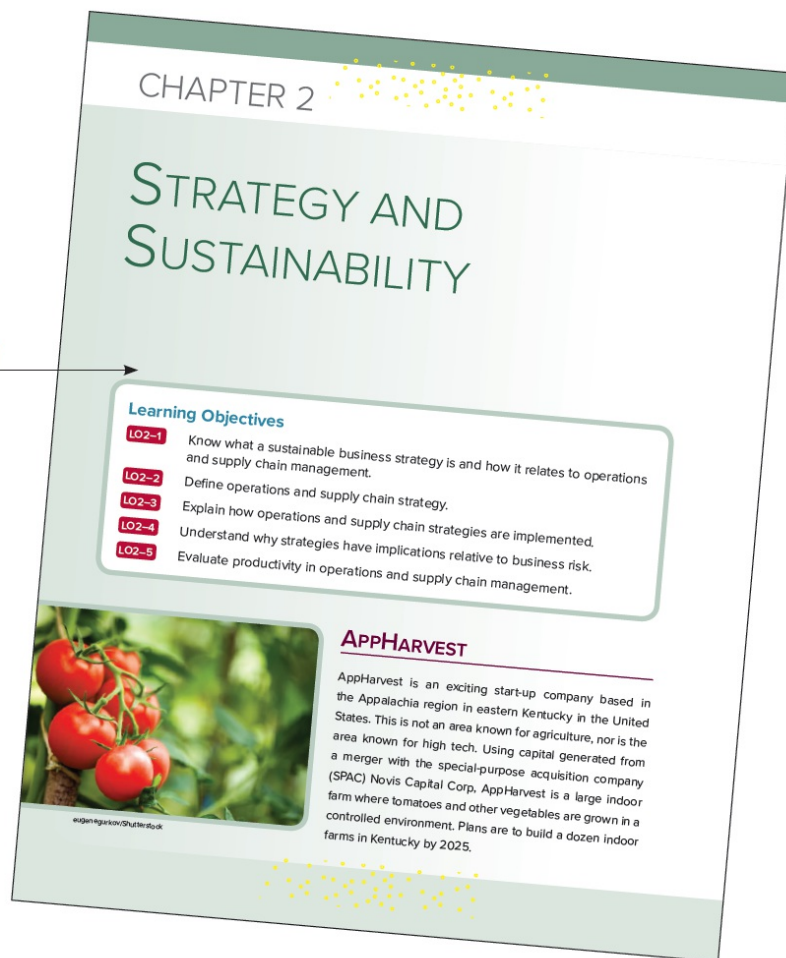


Walkthrough

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



Opening Vignettes

Each chapter opens with a short vignette to set the stage and help pique students' interest in the material about to be studied. A few examples include:

- AppHarvest, Chapter 2
- From Bean to Cup: Starbucks Global Supply Chain Challenge, Chapter 3
- Inside an iPhone, Chapter 9
- How the Covid-19 Pandemic Led to Empty Shelves, Chapter 13

disruptions to critical supplies and the movement of these supplies for the future. Our global community is connected by the supply chains that move goods and services to every location on the earth. When these operations and supply chain links are broken, life as we know it changes quickly. Examples include the loss of critical medical supplies, and the closure of local businesses that impact the economic health of a community.

Really successful firms have a clear and focused idea of how they intend to make money. Be it high-end products or services that are custom-tailored to the needs of a single customer, or generic, inexpensive commodities that are bought largely based on cost, competitively producing and distributing these products is a great challenge.

In the context of major business functions, operations and supply chain management involves specialists in product design, purchasing, manufacturing, service operations, logistics, and distribution. These specialists are mixed and matched in many ways depending on the product or service. For a firm that sells electronic devices, like Apple, these are the functions responsible for designing the devices, acquiring materials, coordinating equipment resources to convert material to products, moving the product, and exchanging the final product with the customer.

Some firms are focused on services, such as a hospital. Here, the context involves managing resources, including the operating rooms, labs, and hospital beds used to nurse patients back to health. In this context, acquiring materials, moving patients, and coordinating resource use are keys to success. Other firms are more general, such as Amazon. Here, purchasing, website services, logistics, and distribution need to be carefully coordinated for success.

In our increasingly interconnected and interdependent global economy, the process of delivering finished goods, services, and supplies from one place to another is accomplished by means of mind-boggling technological innovation, clever new applications of old ideas, seemingly magical mathematics, powerful software, and old-fashioned concrete, steel, and muscle. This book is about doing this at low cost while meeting the requirements of demanding customers. Success involves the clever integration of a great operations-related strategy, processes that can

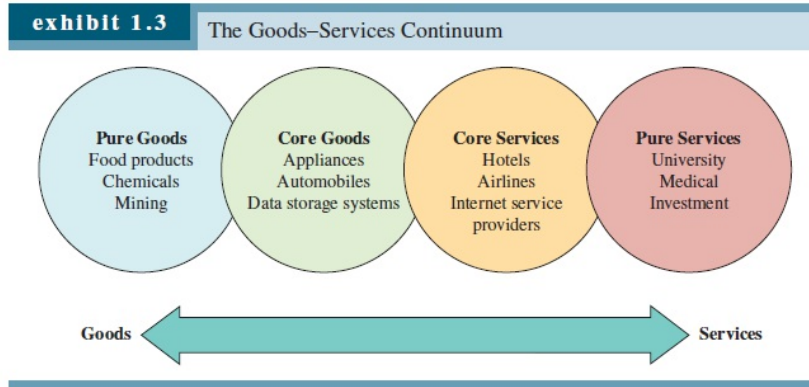


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Photos and Exhibits

Photos and exhibits in the text enhance the visual appeal and clarify text discussions. Many of the photos illustrate additional examples of companies that utilize the operations and supply chain concepts in their business.



BUSY FEDEX HUBS MOVE THOUSANDS OF PACKAGES ALONG CHUTES AND CONVEYOR BELTS UNDER THE WATCHFUL EYES OF HUB EMPLOYEES.
Daniel Acker/Bloomberg/Getty Images

