



MICHAEL H. HUGOS

ESSENTIALS of

Supply Chain Management

Third Edition

- Understand what a supply chain is and how it works
- Utilize the latest technologies to boost efficiency and responsiveness
- Discover new trends and techniques such as RFID and BPM
- Align your supply chain with market demands

ESSENTIALS **of Supply Chain** **Management**

Third Edition

Essentials Series

The Essentials Series was created for busy business advisory and corporate professionals. The books in this series were designed so that these busy professionals can quickly acquire knowledge and skills in core business areas.

Each book provides need-to-have fundamentals for those professionals who must:

- Get up to speed quickly, because they have been promoted to a new position or have broadened their responsibility scope
- Manage a new functional area
- Brush up on new developments in their area of responsibility
- Add more value to their company or clients

Books in this series include:

Essentials of Business Ethics by Denis Collins

Essentials of Corporate and Capital Formation by David H. Fater

Essentials of Corporate Fraud by Tracy L. Coenen

Essentials of Corporate Governance by Sanjay Anand

Essentials of Enterprise Compliance by Susan D. Conway and Mara E. Conway

Essentials of Financial Risk Management by Karen A. Horcher

Essentials of Foreign Exchange Trading by James Chen

Essentials of Intellectual Property, Second Edition by Alexander I.

Poltorak and Paul J. Lerner

Essentials of Managing Treasury by Karen A. Horcher

Essentials of Online Payment Security and Fraud Prevention

by David Montague

Essentials of Risk Management in Finance by Anthony Tarantino with

Deborah Cernauskas

Essentials of Sarbanes-Oxley by Sanjay Anand

Essentials of Supply Chain Management 3rd Edition by Michael Hugos

Essentials of Technical Analysis for Financial Markets by James Chen

Essentials of Venture Capital by Alexander Haislip

Essentials of Working Capital Management by James Sagner

For more information on any of the above titles, visit www.wiley.com.

ESSENTIALS **of Supply Chain** **Management**

Third Edition

Michael Hugos



John Wiley & Sons, Inc.

Copyright © 2011 by John Wiley & Sons. All rights reserved.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Published simultaneously in Canada.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600, or on the Web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993, or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books. For more information about Wiley products, visit our web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Hugos, Michael H.

Essentials of supply chain management / Michael Hugos. -- 3rd ed.
p. cm. -- (Essentials series)

Includes index.

ISBN 978-0-470-94218-5 (paperback); ISBN 978-1-118-10060-8 (ebk);

ISBN 978-1-118-10061-5 (ebk); ISBN 978-1-118-10062-2 (ebk)

1. Business logistics. I. Title.

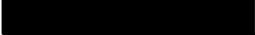
HD38.5.H845 2011

658.7--dc22

2011008883

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1



To my wife,
Venetia

Contents

	Book Manifesto	ix
	Preface	xiii
Chapter 1	Key Concepts of Supply Chain Management	1
Chapter 2	Supply Chain Operations: Planning and Sourcing	39
Chapter 3	Supply Chain Operations: Making and Delivering	75
Chapter 4	Using Information Technology	109
Chapter 5	Metrics for Measuring Supply Chain Performance	147
Chapter 6	Supply Chain Coordination	183
Chapter 7	Supply Chain Innovation for the Real-Time Economy	213
Chapter 8	Defining Supply Chain Opportunities	241
Chapter 9	Creating Supply Chains for Competitive Advantage	273
Chapter 10	The Promise of the Real-Time Supply Chain	307
	About the Author	323
	Index	325



Book Manifesto

This book is dedicated to the idea that there is a set of highly effective concepts and practices that supply chain professionals can use to significantly increase the competitiveness and profitability of their companies. Even though supply chains and the technology they employ are changing rapidly, these concepts and practices remain highly relevant over time—they are the essentials of supply chain management.

From decades of personal experience in the field and from many conversations and reading the works of other supply chain professionals and researchers, I have distilled out these supply chain essentials. I know you are busy and your time is valuable so I make every attempt to get to the point quickly and explain things clearly and concisely. This book provides a framework to understand the structure and operation of any supply chain. It also provides guidance in how to make effective use of the flood of new supply chain technologies, and how to operate the constantly changing real-time supply chains that support our global economy.

Supply Chains as Massively Multi-Player Online Role Playing Games

One of the most promising new technologies for designing and coordinating the operation of supply chains comes from the world of online gaming. I'm referring to a type of game called a "massively multi-player

online role playing game” (MMORPG). In these online games, players from all over the globe log into virtual worlds via the Internet; they learn different roles and skill sets, and come together in self-selecting teams to carry out missions in pursuit of common goals. Question: How is this any different than the challenges that await us in the global real-time economy we now inhabit?

If you’re part of the generation just starting out in business, answers to this question probably seem pretty obvious. If you’re part of a generation that’s already been in business for a while, answers might not seem so obvious (at first). Unfortunately, the word “game” is associated with activities that seem frivolous or unimportant. That is not what I mean here; please hold your judgement while I explain. Popular MMORPGs such as EVE-Online and World of Warcraft bring together hundreds of thousands of simultaneous online players from countries around the globe to interact in complex, realistic three dimensional worlds. What if we did the same to design, monitor and operate the global supply chains that support our real-time economy?

As a companion to this book I have collaborated with a group of people to create a massively multi-player online role playing game to use for gaining a better understanding of the dynamics that underlie supply chains and their operations. This game allows people from all over the world to collaborate in the design and operation of supply chains. In effect, the game creates one big “sandbox” where people can experiment with the effects of different supply chain designs. It can be used to model real or imaginary supply chains and simulate their operations. It will show the performance characteristics and operating costs of these supply chains under different circumstances. The purpose of this game is to engage people in an interactive experience that accelerates their learning and increases their mastery of the skills involved in supply chain management.

The ideas behind this game and its operation are explored in more detail in Chapter 7—Supply Chain Innovation for the Real-Time Economy. The game is titled “SCM Globe” and it can be accessed through my web site at www.MichaelHugos.com.

A Real-Time Supply Chain Simulation System

SCM Globe is a simulation game that provides a map of the world and on that map, people working together in supply chains can draw in their factories, warehouses, retail stores, and the transportation routes such as roads, railways, and harbors that connect those locations. Then people can define the production volumes of the factories, storage capacity of the warehouses, and movement capacity of the different modes of transportation. And finally, they can associate operating costs with each facility and each mode of transportation.

This supply chain game has some pretty challenging dynamics. Players need to figure out how to deliver products where and when they are needed to meet demand while at the same time minimizing inventory levels and holding down transportation and manufacturing costs. If you succeed in keeping down inventory levels and costs but fail to meet product demand, you lose. And if you always deliver the products but fail to keep the other factors under control, then your costs get out of hand and you don't make any money.

If supply chain professionals and researchers can literally draw supply chain designs on an electronic map display and simulate the operations of those supply chains over some time period, they will quickly learn what designs produce the best results. And in the process, they will become immersed and involved in exploring supply chain dynamics. How long would it be before the people playing such a game developed high

Book Manifesto

levels of skill in designing and operating high performance supply chains that responded effectively to changing market conditions? I invite you to try this game and see for yourself. This game is an evolving work in progress and I invite your feedback. Your feedback on what you like and what additional features you would like to see will guide the enhancement of this system.

To explore this real-time supply chain simulation system (or supply chain MMO depending on how you look at it) please visit my website, www.MichaelHugos.com, and click on the link to “SCM Global.”

MICHAEL HUGOS

Chicago, IL USA

www.MichaelHugos.com

Email: mhugos@yahoo.com



Preface

In this book my intention is to provide a clear framework for understanding the essential concepts of supply chain management. Then build on that understanding and show how to develop and deploy supply chains to achieve success in the fast-paced, global economy we all live in. Chapters 1, 2, and 3 provide an introduction to the basic principles and business activities that drive supply chain operations. Chapters 4, 5, and 6 discuss techniques, technologies, and metrics for use in managing a company's internal supply chain operations and coordinating them with those of its supply chain partners.

Chapter 7 is an exploration of the ways that new technologies and new operating procedures can be used to significantly impact and improve the way supply chains are monitored and managed. Specific examples for this kind of innovation are provided.

Chapters 8 and 9 provide a pragmatic approach based on personal experience for defining supply chain opportunities and designing and building systems to effectively respond to those opportunities. I present two business case studies and show how a company in those situations could develop supply chain capabilities to best support its strategic goals. I am glad to answer your questions and discuss the merits of other ideas in addition to the ones I have presented. I can be contacted at my website, www.MichaelHugos.com.

The last chapter, Chapter 10, outlines the opportunities available to companies and alliances of companies that learn to work together to harness the power and potential of real-time supply chains. Real-time

Preface

supply chains are the next step in the evolution of supply chains; they deliver a new level of operating efficiency and responsiveness to markets and customers. Real-time supply chains will support much of the world's economic activity in the years to come.

MICHAEL HUGOS
Center for Systems Innovation
Chicago, Illinois USA
June 2011

ESSENTIALS **of Supply Chain** **Management**

Third Edition

Key Concepts of Supply Chain Management



After reading this chapter you will be able to

- Appreciate what a supply chain is and what it does
- Understand where your company fits in the supply chains it participates in and the role it plays in those supply chains
- Discuss ways to align your supply chain with your business strategy
- Start an intelligent conversation about the supply chain management issues in your company

This book is organized to give you a solid grounding in the “nuts and bolts” of supply chain management. The book explains the essential concepts and practices and then shows examples of how to put them to use. When you finish you will have a solid foundation in supply chain management to work from.

The first three chapters give you a working understanding of the key principles and business operations that drive any supply chain. The next four chapters present the techniques, technologies, and metrics to use to improve your internal operations and coordinate more effectively with your customers and suppliers in the supply chains your company is a part of. Chapter 7 presents specific ideas for using technologies such as social media and real-time simulation gaming to promote supply chain collaboration.

The last three chapters show you how to find supply chain opportunities and respond effectively to best capitalize on these opportunities. Case studies are used to illustrate supply chain challenges and to present solutions for those challenges. These case studies and their solutions bring together the material presented in the rest of the book and show how it applies to real-world business situations.

Supply chains encompass the companies and the business activities needed to design, make, deliver, and use a product or service. Businesses depend on their supply chains to provide them with what they need to survive and thrive. Every business fits into one or more supply chains and has a role to play in each of them.

The pace of change and the uncertainty about how markets will evolve has made it increasingly important for companies to be aware of the supply chains they participate in and to understand the roles that they play. Those companies that learn how to build and participate in strong supply chains will have a substantial competitive advantage in their markets.

Nothing Entirely New...Just a Significant Evolution

The practice of supply chain management is guided by some basic underlying concepts that have not changed much over the centuries. Several hundred years ago, Napoleon made the remark, “An army marches on its stomach.” Napoleon was a master strategist and a skillful general and this remark shows that he clearly understood the importance of what we would now call an efficient supply chain. Unless the soldiers are fed, the army cannot move.

Along these same lines, there is another saying that goes, “Amateurs talk strategy and professionals talk logistics.” People can discuss all sorts of grand strategies and dashing maneuvers but none of that will be possible without first figuring out how to meet the day-to-day demands of providing an army with fuel, spare parts, food, shelter, and ammunition.

It is the seemingly mundane activities of the quartermaster and the supply sergeants that often determine an army's success. This has many analogies in business.

The term “supply chain management” arose in the late 1980s and came into widespread use in the 1990s. Prior to that time, businesses used terms such as “logistics” and “operations management” instead. Here are some definitions of a supply chain:

- “A supply chain is the alignment of firms that bring products or services to market.”—from Lambert, Stock, and Ellram. (Lambert, Douglas M., James R. Stock, and Lisa M. Ellram, 1998, *Fundamentals of Logistics Management*, Boston, MA: Irwin/McGraw-Hill, Chapter 14).
- “A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves.”—from Chopra and Meindl (Chopra, Sunil, and Peter Meindl, 2003, *Supply Chain, Second Edition*, Upper Saddle River, NJ: Prentice-Hall, Inc., Chapter 1).
- “A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers.”—from Ganeshan and Harrison (Ganeshan, Ram, and Terry P. Harrison, 1995, “An Introduction to Supply Chain Management,” Department of Management Sciences and Information Systems, 303 Beam Business Building, Penn State University, University Park, Pennsylvania).

If this is what a supply chain is then we can define supply chain management as the things we do to influence the behavior of the supply

chain and get the results we want. Some definitions of supply chain management are:

- “The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.”—from Mentzer, DeWitt, Keebler, Min, Nix, Smith, and Zacharia (Mentzer, John T., William DeWitt, James S. Keebler, Soonhong Min, Nancy W. Nix, Carlo D. Smith, and Zach G. Zacharia, 2001, “Defining Supply Chain Management,” *Journal of Business Logistics*, Vol. 22, No. 2, p. 18).
- “Supply chain management is the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served.”—my own words.

There is a difference between the concept of supply chain management and the traditional concept of logistics. Logistics typically refers to activities that occur within the boundaries of a single organization and supply chains refer to networks of companies that work together and coordinate their actions to deliver a product to market. Also, traditional logistics focuses its attention on activities such as procurement, distribution, maintenance, and inventory management. Supply chain management acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance, and customer service.

In the wider view of supply chain thinking, these additional activities are now seen as part of the work needed to fulfill customer requests. Supply chain management views the supply chain and the organizations in it as a single entity. It brings a systems approach to understanding

and managing the different activities needed to coordinate the flow of products and services to best serve the ultimate customer. This systems approach provides the framework in which to best respond to business requirements that otherwise would seem to be in conflict with each other.

Taken individually, different supply chain requirements often have conflicting needs. For instance, the requirement of maintaining high levels of customer service calls for maintaining high levels of inventory, but then the requirement to operate efficiently calls for reducing inventory levels. It is only when these requirements are seen together as parts of a larger picture that ways can be found to effectively balance their different demands.

Effective supply chain management requires simultaneous improvements in both customer service levels and the internal operating efficiencies of the companies in the supply chain. Customer service at its most basic level means consistently high order-fill rates, high on-time delivery rates, and a very low rate of products returned by customers for whatever reason. Internal efficiency for organizations in a supply chain means that these organizations get an attractive rate of return on their investments in inventory and other assets and that they find ways to lower their operating and sales expenses.

There is a basic pattern to the practice of supply chain management. Each supply chain has its own unique set of market demands and operating challenges and yet the issues remain essentially the same in every case. Companies in any supply chain must make decisions individually and collectively regarding their actions in five areas:

- 1. *Production***—What products does the market want? How much of which products should be produced and by when? This activity includes the creation of master production schedules that take into account plant capacities, workload balancing, quality control, and equipment maintenance.

2. *Inventory*—What inventory should be stocked at each stage in a supply chain? How much inventory should be held as raw materials, semifinished, or finished goods? The primary purpose of inventory is to act as a buffer against uncertainty in the supply chain. However, holding inventory can be expensive, so what are the optimal inventory levels and reorder points?
3. *Location*—Where should facilities for production and inventory storage be located? Where are the most cost efficient locations for production and for storage of inventory? Should existing facilities be used or new ones built? Once these decisions are made they determine the possible paths available for product to flow through for delivery to the final consumer.
4. *Transportation*—How should inventory be moved from one supply chain location to another? Air-freight and truck delivery are generally fast and reliable but they are expensive. Shipping by sea or rail is much less expensive but usually involves longer transit times and more uncertainty. This uncertainty must be compensated for by stocking higher levels of inventory. When is it better to use which mode of transportation?
5. *Information*—How much data should be collected and how much information should be shared? Timely and accurate information holds the promise of better coordination and better decision making. With good information, people can make effective decisions about what to produce and how much, about where to locate inventory, and how best to transport it.

The sum of these decisions will define the capabilities and effectiveness of a company's supply chain. The things a company can do and the ways that it can compete in its markets are all very much dependent on the effectiveness of its supply chain. If a company's strategy is to serve a mass market and compete on the basis of price, it had better have a supply chain that is optimized for low cost. If a company's strategy is to

serve a market segment and compete on the basis of customer service and convenience, it had better have a supply chain optimized for responsiveness. Who a company is and what it can do is shaped by its supply chain and by the markets it serves.

How the Supply Chain Works

Two influential source books that define principles and practices of supply chain management are *The Goal* (Goldratt, Eliyahu M., 1984, *The Goal*, Great Barrington, MA: The North River Press Publishing Corporation); and *Supply Chain Management, Fourth Edition* by Sunil Chopra and Peter Meindl. *The Goal* explores the issues and provides answers to the problem of optimizing operations in any business system, whether it be manufacturing, mortgage loan processing, or supply chain management. *Supply Chain Management, Fourth Edition* is an in-depth presentation of the concepts and techniques of the profession. Much of the material presented in this chapter and in the next two chapters can be found in greater detail in these two books.



IN THE REAL WORLD

Alexander the Great based his strategies and campaigns on his army's unique capabilities and these were made possible by effective supply chain management.

In the spirit of the saying, "Amateurs talk strategy and professionals talk logistics," let's look at the campaigns of Alexander the Great. For those who think that his greatness was only due to his ability to dream up bold moves and cut a dashing figure in the saddle, think again. Alexander was a master of supply chain management and he could not have succeeded otherwise. The authors from Greek and Roman times who recorded his deeds had little to say about something so apparently unglamorous as how he secured supplies

(Continued)

IN THE REAL WORLD (CONTINUED)

for his army. Yet, from these same sources, many small details can be pieced together to show the overall supply chain picture and how Alexander managed it. A modern historian, Donald Engels, has investigated this topic in his book *Alexander the Great and the Logistics of the Macedonian Army* (Engles, Donald W., 1978, *Alexander the Great and the Logistics of the Macedonian Army*, Los Angeles, CA: University of California Press).

He begins by pointing out that given the conditions and the technology that existed in Alexander's time, his strategy and tactics had to be very closely tied to his ability to get supplies and to run a lean, efficient organization. The only way to transport large amounts of material over long distances was by oceangoing ships or by barges on rivers and canals. Once away from rivers and seacoasts, an army had to be able to live off the land over which it traveled. Diminishing returns set in quickly when using pack animals and carts to haul supplies, because the animals themselves had to eat and would soon consume all the food and water they were hauling unless they could graze along the way.

Alexander's army was able to achieve its brilliant successes because it managed its supply chain so well. The army had a logistics structure that was fundamentally different from other armies of the time. In other armies the number of support people and camp followers was often as large as the number of actual fighting soldiers, because armies traveled with huge numbers of carts and pack animals to carry their equipment and provisions, as well as the people needed to tend them. In the Macedonian army the use of carts was severely restricted. Soldiers were trained to carry their own equipment and provisions. Other contemporary armies did not require their soldiers to carry such heavy burdens but they paid for this because the resulting baggage trains reduced their speed and mobility. The result of the Macedonian army's logistics structure was that it became the fastest, lightest, and most mobile army of its time. It was capable of making lightning strikes against an opponent, often before they were even aware of what was

IN THE REAL WORLD (CONTINUED)

happening. Because the army was able to move quickly and suddenly, Alexander could use this capability to devise strategies and employ tactics that allowed him to surprise and overwhelm enemies that were numerically much larger.

The picture that emerges of how Alexander managed his supply chain is an interesting one. For instance, time and again the historical sources mention that before he entered a new territory, he would receive the surrender of its ruler and arrange in advance with local officials for the supplies his army would need. If a region did not surrender to him in advance, Alexander would not commit his entire army to a campaign in that land. He would not risk putting his army in a situation where it could be crippled or destroyed by a lack of provisions. Instead, he would gather intelligence about the routes, the resources, and the climate of the region and then set off with a small, light force to surprise his opponent. The main army would remain behind at a well-stocked base until Alexander secured adequate supplies for it to follow.

Whenever the army set up a new base it looked for an area that provided easy access to a navigable river or a seaport. Then ships would arrive from other parts of Alexander's empire, bringing in large amounts of supplies. The army always stayed in its winter camp until the first spring harvest of the new year so that food supplies would be available. When it marched, it avoided dry or uninhabited areas and moved through river valleys and populated regions whenever possible so the horses could graze and the army could requisition supplies along the route.

Alexander had a deep understanding of the capabilities and limitations of his supply chain. He learned well how to formulate strategies and use tactics that built upon the unique strengths that his logistics and supply chain capabilities gave him, and he wisely took measures to compensate for the limitations of his supply chain. His opponents often outnumbered him and were usually fighting on their own home territory. Yet their advantages were undermined by clumsy and inefficient supply chains that restricted their ability to act and limited their options for opposing Alexander's moves.

The goal or mission of supply chain management can be defined using Eli Goldratt's words as "Increase throughput while simultaneously reducing both inventory and operating expense." In this definition, throughput refers to the rate at which sales to the end customer occur. Depending on the market being served, sales or throughput occur for different reasons. In some markets, customers value and will pay for high levels of service. In other markets customers seek simply the lowest price for an item.

As we saw in the previous section, there are five areas where companies can make decisions that will define their supply chain capabilities: production; inventory; location; transportation; and information. Chopra and Meindl define the first four and I add the fifth as performance drivers that can be managed to produce the capabilities needed for a given supply chain.

Effective supply chain management calls first for an understanding of each driver and how it operates. Each driver has the ability to directly affect the supply chain and enable certain capabilities. The next step is to develop an appreciation for the results that can be obtained by mixing different combinations of these drivers. Let's start by looking at the drivers individually.

Production

Production refers to the capacity of a supply chain to make and store products. The facilities of production are factories and warehouses. The fundamental decision that managers face when making production decisions is how to resolve the trade-off between responsiveness and efficiency. If factories and warehouses are built with a lot of excess capacity, they can be very flexible and respond quickly to wide swings in product demand. Facilities where all or almost all capacity is being used are not capable of responding easily to fluctuations in demand. On the other hand, capacity costs money and excess capacity is idle capacity not

in use and not generating revenue. So the more excess capacity that exists, the less efficient the operation becomes.

Factories can be built to accommodate one of two approaches to manufacturing:

1. *Product Focus*—A factory that takes a product focus performs the range of different operations required to make a given product line from fabrication of different product parts to assembly of these parts.
2. *Functional Focus*—A functional approach concentrates on performing just a few operations such as only making a select group of parts or only doing assembly. These functions can be applied to making many different kinds of products.

A product approach tends to result in developing expertise about a given set of products at the expense of expertise about any particular function. A functional approach results in expertise about particular functions instead of expertise in a given product. Companies need to decide which approach or what mix of these two approaches will give them the capability and expertise they need to best respond to customer demands.

As with factories, warehouses too can be built to accommodate different approaches. There are three main approaches to use in warehousing:

1. *Stock Keeping Unit (SKU) Storage*—In this traditional approach, all of a given type of product is stored together. This is an efficient and easy to understand way to store products.
2. *Job Lot Storage*—In this approach, all the different products related to the needs of a certain type of customer or related to the needs of a particular job are stored together. This allows for

an efficient picking and packing operation but usually requires more storage space than the traditional SKU storage approach.

- 3. *Crossdocking***—An approach that was pioneered by Wal-Mart in its drive to increase efficiencies in its supply chain. In this approach, product is not actually warehoused in the facility. Instead the facility is used to house a process where trucks from suppliers arrive and unload large quantities of different products. These large lots are then broken down into smaller lots. Smaller lots of different products are recombined according to the needs of the day and quickly loaded onto outbound trucks that deliver the products to their final destinations.

Inventory

Inventory is spread throughout the supply chain and includes everything from raw material to work in process to finished goods that are held by the manufacturers, distributors, and retailers in a supply chain. Again, managers must decide where they want to position themselves in the trade-off between responsiveness and efficiency. Holding large amounts of inventory allows a company or an entire supply chain to be very responsive to fluctuations in customer demand. However, the creation and storage of inventory is a cost and to achieve high levels of efficiency, the cost of inventory should be kept as low as possible.

There are three basic decisions to make regarding the creation and holding of inventory:

- 1. *Cycle Inventory***—This is the amount of inventory needed to satisfy demand for the product in the period between purchases of the product. Companies tend to produce and to purchase in large lots in order to gain the advantages that economies of