

Series on Resource Management

Principles of Supply Chain Management

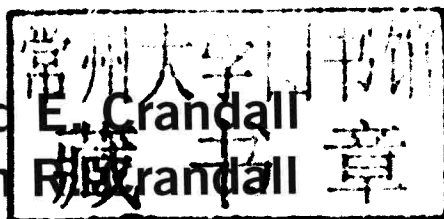
**Richard E. Crandall
William R. Crandall
Charlie C. Chen**



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Dedication

To Jean—yesterday, today, and tomorrow

To Sue, my wife and friend forever

To Fu-Mei, my mother and mentor forever

Preface

Supply chains affect individuals and organizations, both directly and indirectly. “Supply chain” is a term found daily in both trade and academic publications. Whether you are a customer or a supplier, you depend on supply chains for your necessities and luxury goods, as well as various other services. Why are supply chains so pervasive in our everyday lives?

In his book, *The World Is Flat: A Brief History of the Twenty-First Century*, Thomas Friedman listed supply chaining as one of the ten flatteners that would make the world more competitive on a global scale. Supply chains are the mechanisms by which products move from the raw materials stage through a series of transformative processes to the ultimate consumer. As a concept, supply chains are intuitively obvious. We recognize that the cartons of orange juice we buy at the local supermarket originated in an orange grove, or that the automobile we bought at the dealer required a number of supply chains to furnish all of the features included in its assembly. Even when supply chains extend across the world, we understand something about how they operate and why they are important.

When we add the word “management” to “supply chain,” we enter a new conceptual arena. Peter Drucker, one of the most prolific writers about management, offers the following statement in his book entitled simply *Management*:

While management is a discipline—that is, an organized body of knowledge and as such applicable everywhere—it is also “culture.” It is not value-free science. Management is a social function and embedded in a culture—a society—a tradition of values, customs, and beliefs, and in governmental and political systems. Management is—and should be—culture-conditioned; but, in turn, management and managers shape culture and society.

This statement suggests that supply chain management is more than understanding where products come from and how they get to the consumer. In the days when humans lived in caves and never traveled more than a few miles during their entire lives, supply chains were simple and could be easily managed. In present times,

when even the smallest of companies may be dealing with suppliers and markets on a worldwide basis, supply chain management attempts to deal with a myriad of technical, organizational, and cultural challenges. These challenges can be overwhelming, and often defy the rational management practices that worked so well in the past.

In this book, we explain why supply chain management is so different, and more difficult, than managing an individual business or some other form of organization. We examine the various components of a supply chain in detail; we then show how the pieces must fit together if the supply chain is to be effective. We then attempt to outline an approach to achieve supply chain integration that leads to effective management. We conclude that Peter Drucker was right. Supply chain management is more than managing technology and the supporting infrastructure. It requires a blending of organizational cultures within a specific company and among all members of a supply chain.

Acknowledgments

We would like to thank a number of people for helping us to conceive of and then write this book. Much of the credit goes to William T. Walker, or Bill, to most of us who have had the good fortune to call him a colleague and friend. Bill helped us get our first book published with CRC Press, *New Methods of Competing in the Global Marketplace: Critical Success Factors from Service and Manufacturing*. It was a book that dealt with the vanishing boundaries between manufacturing and services sectors, and how knowledge was being transferred between these two major types of businesses. A portion of that book examined the role of supply chains in facilitating knowledge transfer. It was thus a natural evolution to extend a portion of that work to a full-blown textbook on supply chain management. In this book, Bill has read every chapter and offered a number of insightful suggestions to clarify and organize the topics in a meaningful way. Thank you, Bill, for your continued support.

We are especially grateful to Jennifer Proctor, editor in chief, and Elizabeth Rennie, managing editor, of the *APICS Magazine*. With their permission, we drew heavily from the following Relevant Research columns written by Dick.

- Crandall, R. E., What's really going on here? Exploring approaches to supply chain management, *APICS Magazine*, 19, 3, 26, 2009.
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Thanks, Jennifer and Elizabeth, for your help and encouragement.

We would like to thank all of the companies we worked for during our time in industry prior to joining the academic ranks. Dick spent over 25 years in industry working for manufacturing companies in the electronic industries, service companies in wholesale and retail, and an international consulting company, where he worked with a variety of manufacturing and service companies. Rick spent over 10 years in the food service industry, most of which was with ARAMARK in contract food services. Charlie's area of expertise is information technology and he has extensive international experience, especially in Taiwan, Japan, and China. We believe that our varied backgrounds have enabled us to take a panoramic view of global supply chains.

To supplement our own experience, we dug deeply into some of the extensive research by practitioners, consultants, and academics. We reviewed hundreds of articles and dozens of books to uncover the concepts, principles, and techniques that we have included in this book. We hope the information in this book will be helpful to you in your business career.

Amy Blalock, the project coordinator for our book at CRC Press, has been helpful in providing guidance about all of the things we needed to do and has answered any number of questions that we came up with. Amy, we appreciate your understanding and patience in our stumbles. Thanks for covering for us, and for helping us through all the steps in preparing the book for publication.

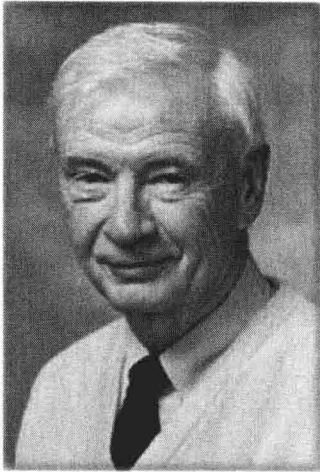
We would like to thank Ray O'Connell, editor, Taylor & Francis Group. Ray provided the initial impetus to this book by helping us focus our thinking through a careful evaluation of our proposal and early work. Unfortunately, Ray passed away during the preparation of the book. We will miss his insights and inspiration. Fortunately, Maura May, publisher, business improvement for CRC Press, Taylor & Francis Group, replaced Ray with Michael Sinocchi, senior acquisitions editor, and we look forward to his leadership as this book enters the marketplace.

When we submitted our original typewritten pages of the manuscript to the editor, we wondered how it could ever look as professional as most of the books we read in our daily work. Now we know it takes professionals like our project editor Richard Tressider to make that transformation possible. We would also like to thank all of those who had the unenviable job of trying to make our words sound enlightened, or at least less obtuse, as well as worrying about grammar, punctuation, pagination, location of exhibits, and all those other things we were very willing to outsource. We are sure that there are a number of other people at CRC Press who helped make this book a reality. However, in this age of electronic communication, we do not always have a chance to meet everyone personally. Thank you; we hope you enjoyed it as much as we did.

Finally, we would like to specially acknowledge the contributions of Jean, wife of Dick and mother of Rick. She encouraged us, but, even more importantly, she read every word (several times) and offered many helpful suggestions. Despite her best efforts, there may still be errors. If you find them, blame us, not her, or any of the people mentioned above.

Richard E. (Dick) Crandall
William R. (Rick) Crandall
Charlie C. Chen

Authors



Richard E. “Dick” Crandall is a professor in the College of Business at Appalachian State University (ASU), Boone, North Carolina. He is a certified fellow in production and inventory management (CFPIM) and is a supply chain professional (CSCP) by APICS—The Association for Operations Management. He received his PhD in production/operations management from the University of South Carolina, Columbia and is a registered professional engineer and a certified public accountant. Prior to joining ASU, Dick worked as an industrial engineer and in management positions for manufacturing and service companies. He was a consultant with a major consulting firm, installing systems for both operations and financial applications. With Rick Crandall, he coauthored the book

New Methods of Competing in the Global Marketplace: Critical Success Factors from Service and Manufacturing, published in 2008 by CRC Press, Taylor & Francis.



William “Rick” Crandall currently serves as a professor of management at the University of North Carolina at Pembroke. He received his PhD in business administration with a focus on organizational behavior and human resource management from the University of Memphis, Tennessee. His primary research interest is in the area of crisis management, helping organizations cope with catastrophic events. He is the author of the new book, *Crisis Management in the New Strategy Landscape* (coauthored with John Parnell and John Spillan, also of the University of North Carolina

at Pembroke), released by Sage Publications. He is also active in researching issues related to supply chain management. Prior to entering higher education, Dr. Crandall worked in management for ARA Services (now ARAMARK), a service management firm based in Philadelphia.



Charlie C. Chen was educated at Claremont Graduate University, California and received his PhD in management information systems. He is an associate professor in the Department of Computer Information Systems at Appalachian State University, Boone, North Carolina. His research interests include project management and supply chain management. He is a member of the Association for Information Systems and Decision Sciences Institute, and is certified by the Project

Management Institute as a project management professional (PMP). Dr. Chen has published in journals such as *Communications of Association for Information Systems*, *Behaviour and Information Technology*, *Journal of Knowledge Management Research, Practice*, and the *Journal of Information Systems Education*. Dr. Chen is a dedicated transnational scholar and is a trip leader for study-abroad programs in Asia (Japan and Taiwan).

Introduction

This is a book about supply chain development and management. Supply chains are made up of a complex variety of businesses and support organizations. In this book, we first describe the component parts and then explain how they are put together to make an integrated entity—the supply chain—that provides products and services the consumer wants, effectively and efficiently.

The book is divided into six major parts, as shown in Figure 1. We explain why supply chains are important, how they are presently evolving, and look ahead to additional developments in the future. In each chapter, we provide descriptions and examples to adequately explain each topic. In addition, we describe some topics in more detail because they are newer or important enough to merit the added coverage.

Part I. Overview of Supply Chain Management

This part describes supply chains and explains why supply chain implementation and management became imperative for most businesses during the last decade of the twentieth century.

Chapter 1. Evolution of Supply Chains

This chapter describes the evolution of supply chains from a disconnected series of steps in moving products from the point of origin to the point of consumption, to a seamlessly integrated flow of goods. It also describes the present business, and nonprofit and governmental environments in which supply chains operate.

Chapter 2. Supply Chains as a System

This chapter describes the input–transformation–output (ITO) element and shows how these elements are linked together to form functioning supply chains for both manufacturing and service businesses. The ITO model is the DNA of the supply chain. The inputs are things and people; the economic inputs, such as employees, equipment, facilities, and systems, are resources employed in the transformation processes. In addition to the flow of goods and services, supply chains must support the flow of information and money.

Principles of Supply Chain Management, Theory, and Practice in an Evolving World

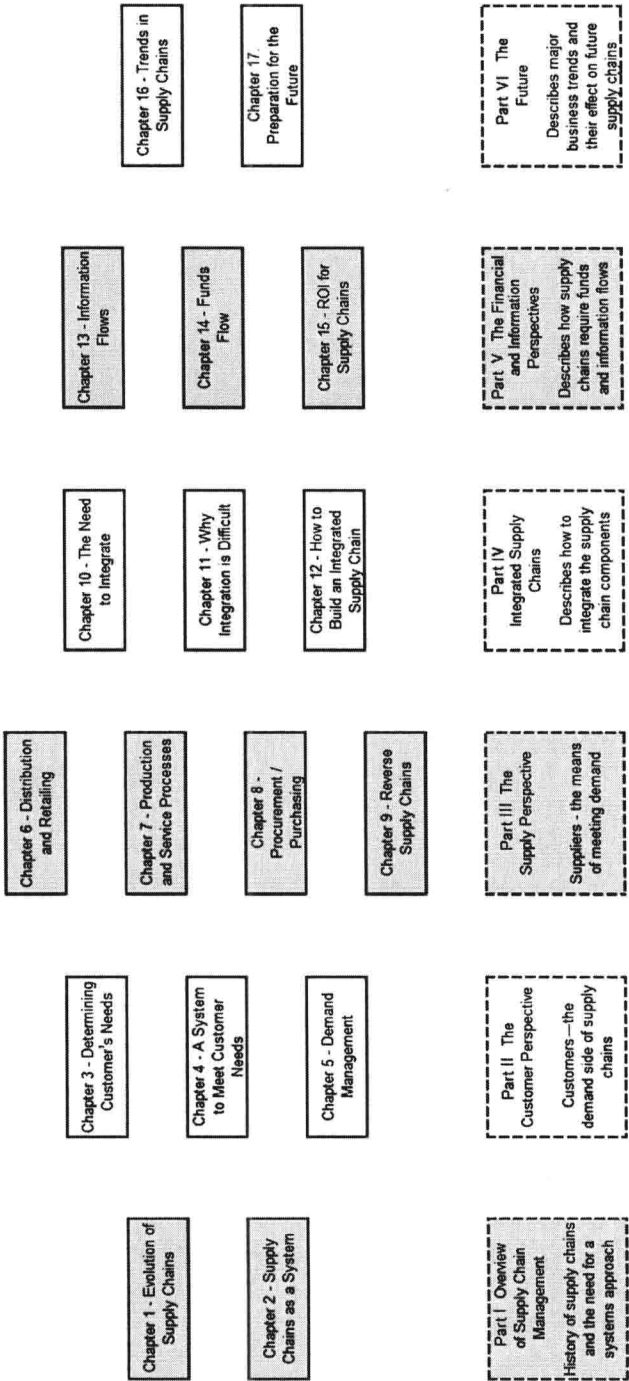


Figure 1 Outline of chapters.

Part II. The Customer Perspective

In Chapters 1 and 2, we described supply chains as complete systems. In Part II, we look at the customer, or demand, side of the supply chain. Chapter 3 describes ways to forecast demand. Chapter 4 describes systems that enable companies to meet demand. Chapter 5 explains some of the supply strategies companies can use to most effectively and efficiently satisfy demand.

Chapter 3. Determining Customer's Needs

This chapter describes the process of identifying customer segments and determining each customer's needs and wants. It describes how businesses must work within an open system environment to identify types and amounts of customer demand. The chapter also describes the attributes of a well-designed product and the processes used to design those products and services.

Chapter 4. A System to Meet Customer Needs

This chapter takes the information developed in Chapter 3 and transforms it into an operational system to meet the identified needs and wants of customers. The design process is described for a typical supply chain with some variations noted for different supply chain requirements. The chapter includes explanations of such topics as supply chain mapping, customer relationship management, and product lifecycle management.

Chapter 5. Demand Management

This chapter considers how customer demand can best be satisfied. It describes how different demand management strategies fit with different types of businesses. The chapter describes these predominant strategies and illustrates how a company can decide which strategy to choose.

Part III. The Supply Perspective—Distribution, Production, and Procurement

This series of chapters describe the supply side of the supply chain. It includes the three major functional areas of distribution, production, and procurement. It also includes a description of the reverse supply chain, and the service side of the product/service bundle.

Chapter 6. Distribution and Retailing

This chapter describes the functional areas closest to the consumer—the wholesale and retail activities. It describes the history of retailing and some of the pressures for change, such as from the e-commerce sector. The chapter also describes the wholesale and distribution functions and their increasing importance in today's supply chains.

Chapter 7. Production and Service Processes

The production, or manufacturing, function is at the heart of most supply chains. This chapter describes the evolution of manufacturing from the craft age to mass production to mass customization, and how these transitions have both helped and made more demanding the development of supply chains. Outsourcing some, or all, of the manufacturing function has extended the scope and complexity of supply chains. Changes in production require major transitions in technology, infrastructure, and company cultures.

Chapter 8. Procurement/Purchasing

This chapter deals with the supply side to production. Purchased materials and services represent over half of the product costs in most industries. As more companies move to a “core competency” strategy, they will outsource more of the component manufacturing to suppliers and become primarily an assembly operation. The chapter also describes the transition of the purchasing function in its movement from a technician level to a leading strategic participant in supply chain development and management.

Chapter 9. Reverse Supply Chains

The previous chapters described activities in the supply chain that move goods and services toward the ultimate consumer. This chapter describes the activities that handle the flow of goods, and the accompanying services, in the reverse direction, commonly termed reverse logistics. It also presents the broader role of reverse supply chains in the sustainability area and the roles of private industries, governments, and special interest groups in this rapidly growing movement.

Part IV. Integrated Supply Chains

In earlier chapters, we described individual components of a supply chain. In this part, we describe the need to link those components into an integrated supply chain. It is first necessary to integrate the functions within one company and then to integrate that company with other members of the supply chain. We devote three chapters to this important topic of integrated supply chains. In Chapter 10, we discuss why it is important to work toward integrated supply chains. In Chapter 11, we identify obstacles encountered in building the integrated supply chain and in Chapter 12, we provide ideas on how to implement an integrated supply chain. Very few, if any, companies have completely integrated supply chains; however, like zero defects and zero inventory, it is a noble objective—a journey to be traveled, not simply a destination to be attained.

Chapter 10. The Need to Integrate

This chapter describes the need to move to an integrated supply chain. It is a major decision for a company and requires top management support and participation because it requires major costs and commitment of resources, especially from key

management stakeholders. Very few companies have moved completely to an integrated supply chain. Organizational and cultural changes are difficult, and the chapter devotes some time to a description of the important change management process.

Chapter 11. Why Integration Is Difficult

This chapter explores why it is difficult to implement an integrated supply chain. Apart from the complexity of the task, it requires implementing positive moves with technology, as well as overcoming the natural resistance to change that is present in many organizations.

Chapter 12. How to Build an Integrated Supply Chain

This chapter outlines an approach to building an integrated supply chain. We provide a comprehensive model to illustrate the steps in the process. Although these steps toward integration are apparent, they are not easy to achieve. The needed attributes of collaboration and trust prove to be very elusive in many supply chains.

Part V. The Financial and Information Technology Perspectives

The first 12 chapters describe the physical aspects of the supply chain and the flow of goods and services. In this part, we describe the information and funds flow among supply chain participants.

Chapter 13. Information Flow along the Supply Chain

This chapter describes information flows along the supply chain. While some aspects of information flow are covered during earlier chapters, this chapter describes in more depth the applications and technologies used in creating the necessary information flows along the supply chain. Topics include established technologies such as computer-aided design, bar codes, and electronic data interchange. We also describe some of the newer technologies such as radio frequency identification, service-oriented architecture, software as a system, product lifecycle management, and cloud computing.

Chapter 14. Funds Flow along the Supply Chain

This chapter describes the funds, or money flows, along the supply chain. It overviews applications of the technology used to electronically move funds between supply chain partners. We also point out that the effectiveness of fund flows depend not only on technology but also on the seamless flow of the goods and information along the supply chains. After all, customers do not pay until they receive the goods.

Chapter 15. ROI for Supply Chains and Other Issues

If supply chains are to be effective, each member of the supply chain must receive an appropriate benefit or return on their investment. How to share the benefits, as

well as the costs of supply chain operation, is still an emerging concept. We present all the information necessary to determine how the sharing can be done. We also describe the difficulties in making equitable distributions along the supply chain.

Part VI. The Future

At the present time, very few companies have implemented completely effective supply chains. While the topic is of current interest, will there be a time when companies will lose interest in supply chain management and move on to some new program? If so, what will it be?

Chapter 16. Trends in Supply Chain Development and Management

Changes in the business environment have triggered the need for integrated supply chains. Will changes in the future reinforce the need for supply chains or make them less beneficial? In this chapter, we examine some of the more significant trends in supply chain development, such as offshore outsourcing, global competition, increased complexity and risk, knowledge management, sustainability awareness, and technology innovations.

Chapter 17. Preparation for the Future

While the future will not be like the past, it is difficult, if not impossible, to forecast all of the variations that could arise in the future. Thus, a company must be prepared to provide some structure, such as what is needed in a supply chain, but also be prepared to adapt to changing conditions. Supply chains are loosely coupled collaborative relationships that operate in an ever-evolving world. Skill and perseverance must be coupled with awareness and agility for a company to survive.

We hope you find this book to be informative and helpful in your pursuit of knowledge about supply chains. We have no doubt you will be, in some way, involved in the development of supply chains in your future business career.