

THE  
ESSENTIALS  
of  
SUPPLY CHAIN  
MANAGEMENT

NEW BUSINESS CONCEPTS AND APPLICATIONS



H O K E Y M I N

*James R. Good Chair in Global Supply Chain Strategy, Bowling Green State University*

*The Essentials of  
Supply Chain Management*

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# *The Essentials of Supply Chain Management*

**New Business Concepts and Applications**

**Hokey Min**

*James R. Good Chair in Global Supply Chain Strategy at  
Bowling Green State University*

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*This book is dedicated to my late father B.J. Min, my mother H.W. Seo,  
my wife Christine, and my son Alexander Snow.*

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**Dr. Hokey Min** is the James R. Good Chair in Global Supply Chain Strategy in the Department of Management at the Bowling Green State University. He was Professor of Supply Chain Management, Distinguished University Scholar, and Founding Executive Director of the Logistics and Distribution Institute (LoDI), the UPS Center for World-wide Supply Chain Management, and the Center for Supply Chain Workforce Development at the University of Louisville. He earned his Ph.D. degree in Management Sciences and Logistics from Ohio State University. His expertise includes global logistics strategy, healthcare supply chains, closed-loop supply chains, e-synchronized supply chains, service benchmarking, and supply chain modeling. He has published more than 170 scholarly articles in various refereed journals including *European Journal of Operational Research*, *Journal of Business Logistics*, *International Journal of Physical Distribution and Logistics Management*, *Journal of Supply Chain Management*, *Supply Chain Management: An International Journal*, *Journal of the Operational Research Society*, *International Journal of Production Research*, *International Journal of Production Economics*, *Transportation Journal*, and *Transportation Research*. He recently authored a book titled *Healthcare Supply Chain Management: Basic Concept and Principles*. He has also engaged in numerous consulting projects with more than 50 different organizations including UPS, Brown-Forman Beverage World-Wide, Syntel Inc., Nationwide Insurance, National Tobacco Company, Time-It Transportation, Pegasus Transportation Inc., Usher Transport Inc., Nagle Trucking, Houston-Johnson Inc., Master Halco, Briggs and Stratton, West-Point Stevens, ScanSteel Inc., Dixie Warehouse Services, GenLyte Thomas Industries, Owens Corning, Buckeye Cable Systems, Andersons Inc., BioFit, Kentucky Motor Transport Association, Korea Maritime Institute (KMI), Korea Ocean Research Development Institute (KORDI), The Korea Research Institute of Ships & Ocean Engineering (KRISO), and The Chinese Rural Energy & Environment Agency.



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# 1

## Principles of Supply Chain Management

*“Silos—and the turf wars they enable—devastate organizations.”*

—Patrick Lencioni, *Silos, Politics and Turf Wars*

### Learning Objectives

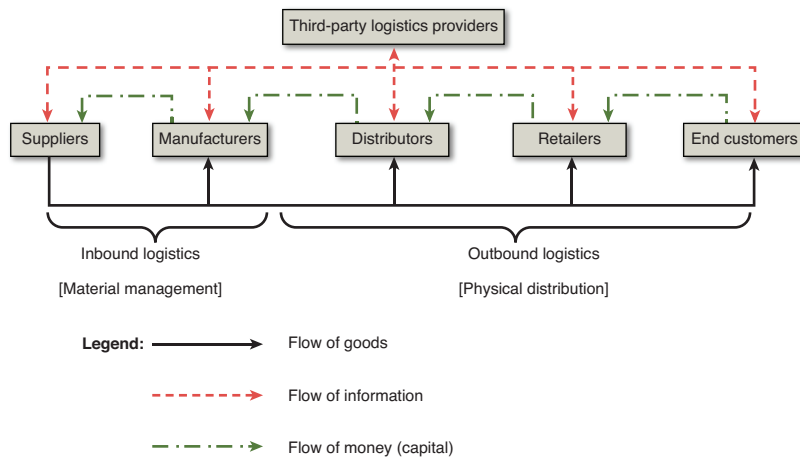
After reading this chapter, you should be able to:

- Understand the rationale behind and fundamental principles of supply chain management.
- Comprehend the differences between supply chain perspectives and traditional business perspectives.
- Identify the main drivers of supply chain links.
- Recognize the managerial benefits and potential challenges of the supply chain practices.
- Analyze the impact of supply chain management on the bottom line and the competitiveness of the organization.
- Understand the necessary changes and transformations required for the successful implementation of the integrated supply chain perspectives.
- Find ways to leverage the supply chain for business success.

### Evolution of the Supply Chain Concept

Over the years, most firms have focused their attention on the effectiveness and efficiency of separate business functions such as purchasing, production, marketing, financing, and logistics. The lack of connectivity among these functions, however, can lead to sub-optimal organizational goals and create inefficiency by duplicating organizational efforts and resources. To capture the synergy of interfunctional and interorganizational integration and coordination across the supply chain and to

subsequently make better strategic decisions, a growing number of firms have begun to realize the strategic importance of planning, controlling, and designing a supply chain as a whole. In today’s global marketplace, individual firms no longer compete as independent entities with unique brand names, but rather as integral parts of supply chain links. As such, the ultimate success of a firm will depend on its managerial ability to integrate and coordinate the intricate network of business relationships among supply chain partners (Drucker, 1998; Lambert and Cooper, 2000). A supply chain is referred to as an *integrated system* that synchronizes a series of interrelated business processes in order to: (1) create demand for products; (2) acquire raw materials and parts; (3) transform these raw materials and parts into finished products; (4) add value to these products; (5) distribute and promote these products to either retailers or customers; (6) facilitate information exchange among various business entities (e.g., suppliers, manufacturers, distributors, third-party logistics providers, and retailers). Its main objective is to enhance the operational efficiency, profitability, and competitive position of a firm and its supply chain partners. More concisely, supply chain management is defined as “the integration of key business processes from end-users through original suppliers that provide products, services, and information and add value for customers and other stakeholders” (Cooper et al., 1997b, p. 2). A supply chain is characterized by a forward flow of goods and a backward flow of information, as illustrated by Figure 1.1 (Min and Zhou, 2002, p. 232).



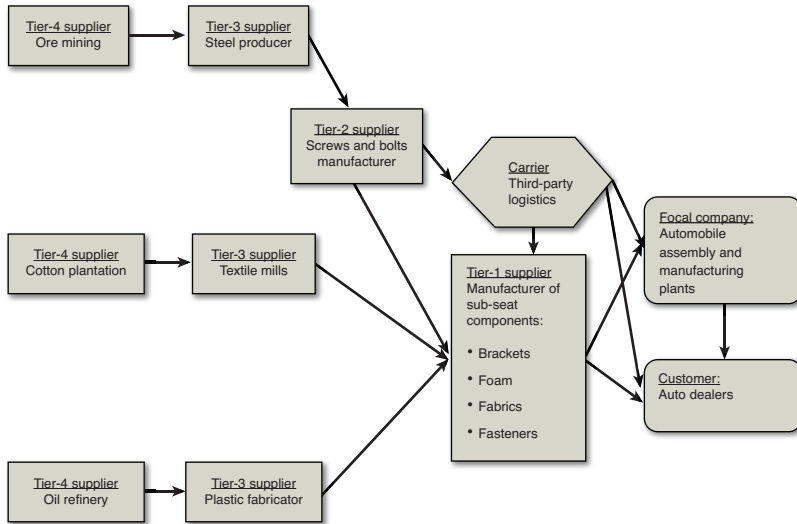
**Figure 1.1.** *The supply chain process*

Typically, a supply chain is composed of two main business processes:

- Material management (inbound logistics)
- Physical distribution (outbound logistics)

Material management is concerned with the acquisition and storage of raw materials, parts, and supplies. To elaborate, material management supports the complete cycle of material flow—from the purchase and internal control of production materials, to the planning and control of work-in-process, to the warehousing, shipping, and distribution of finished products (Johnson and Malucci, 1999). On the other hand, physical distribution encompasses all outbound logistics activities related to providing customer service. These activities include order receipt and processing, inventory deployment, storage and handling, outbound transportation, consolidation, pricing, promotional support, returned product handling, and life-cycle support (Bowersox and Closs, 1996).

Combining the activities of material management and physical distribution, a supply chain does not merely represent a linear chain of one-on-one business relationships, but a web of multiple business networks and relationships. Along a supply chain, there may be multiple stakeholders, composed of various suppliers, manufacturers, distributors, third-party logistics providers, retailers, and customers. For example, a supply chain for typical automobile seats linking suppliers, manufacturers, third-party logistics providers, and customers is graphically illustrated in Figure 1.2. As shown in this figure, the supply chain begins with customers such as Ford, General Motors, and Fiat-Chrysler, who need to use automobile seats as critical parts of their manufactured cars. At the next upstream stage of the supply chain, the car manufacturer often purchases automobile seats from the original equipment manufacturer (OEM). This OEM needs to acquire the parts and components of the automobile seats, including brackets, foam, fabric, and fasteners from tier-one suppliers fabricating those parts and components. Because these parts and components are made of metals, screws, bolts, plastics, and textiles, the tier-one suppliers should acquire some simple parts and raw materials from tier-two suppliers, who should obtain such parts and materials from tier-three suppliers such as steel and yarn producers. These tier-three suppliers, in turn, obtain their sources of materials from ore mining and cotton plants at the furthest upstream of the supply chain. In case logistics activities involving the movement, handling, storage, and packaging of these materials, parts, components, and finished goods are outsourced from third-party logistics providers, the complexity of the supply chain network will be increased due to the possibility of both forward and reverse flow of products. As illustrated by this example, the typical supply chain cannot be explained by a linear linkage among the supply chain members.



**Figure 1.2.** *The supply chain network for automobile seats*

In a nutshell, the concept of supply chain management has evolved around a customer-focused corporate vision, which drives changes throughout a firm's internal and external linkages and then captures the synergy of interfunctional, interorganizational integration and coordination. Herein, integration does not entail merger/acquisition or equity of the ownership of other organizations. The successful integration of the entire supply chain process can bring about a number of bottom-line benefits (Schlegel, 1999):

- **Improved customer service and value added**—Customer service can be improved through increased inventory availability, better on-time delivery performances, higher order fill rates, and lower post-sales costs.
- **Enhanced fixed capital**—Fixed capacity is maximized through a strategic partnership and joint planning that can increase overall capacity and throughput.
- **Utilized asset**—Asset utilization can be maximized by increasing inventory turns and closely aligning supply with demand.
- **Increased sales and profitability**—The ability to assess outcomes due to price changes, promotional events, and new product development can be enhanced through increased visibility resultant from information sharing among supply chain partners.

Financial benefits can be accrued from successful supply chain integration. For instance, thanks to streamlined supply chain integration, Dell's personal computer (PC) market share in the U.S. grew from 2.7% in 1995 to 24.1% in 2014 (Gartner, 2014). Similarly, Walmart, which happens to be another supply chain leader, enjoyed the

rapid growth of its market share from 6.8% in 1992 to 17.1% in 2004 before declining to 11.4% in 2013 (Foster, 2006; Statistica, 2014). Despite these benefits of supply chain integration, firms engaged in this effort must be aware of the various challenges because of the unprecedented number and diversity of products and services available to customers in the era of mass customization. This variety will make it more difficult for a firm to predict customer needs and requirements. Therefore, the consequence of making forecasting errors will be more serious than ever before. Unfortunately, in a stretched supply chain with complex layers of suppliers and distributors, the severity of forecasting errors could be far beyond the level of compromise. Hardest hit by such forecasting errors are often upstream suppliers with little resources whose visibility of true demand is blindsided by distorted information passed by their immediate customers (e.g., manufacturers) and other downstream customers (e.g., distributors and retailers). This phenomenon was often explained by the so-called “bullwhip” effect.

The bullwhip effect is generally referred to as an inverse ripple effect of forecasting errors throughout the supply chain that leads to amplified supply and demand misalignment, where orders (perceived demand) to the upstream supply chain member tend to exaggerate the true patterns of end-customer demand because each chain member’s view of true demand can be blocked by its immediate downstream supply chain member (Min, 2000; Lee et al., 1997a). The common symptoms of the bullwhip effect include delayed new product development, constant shortages and backorders, frequent order cancellations and returns, excessive pipeline inventory, erratic production scheduling, expedited shipments, and chronic overcapacity problems (Min, 2000; Lee et al., 1997b). The failure to mitigate or eliminate the bullwhip effect can disrupt the firm’s revenue driver and adversely affect the firm’s bottom line. According to Hendricks and Singhal (2005), supply chain disruptions led to:

- Significant reduction in stock returns relative to their benchmarks (e.g., 33% to 40% reduction over a three-year period)
- Increased share price volatility (e.g., 13.5% increase in share price volatility one year after supply chain disruptions)
- Decline in profitability (e.g., 107% drop in annual operating income, 7% decline in annual sales growth, and 11% annual total cost increase)
- Debilitating firm performances (e.g., at least two consecutive years of lower performances after supply chain disruptions)

Similarly, another worldwide survey of 602 financial executives conducted by FM Global and Harris Interactive indicates that supply chain disruptions are the biggest threat to a firm’s revenue drivers (Yang and Gonzalez, 2006). Considering the enormous impact of supply chain disruptions on a firm’s financial status, today’s firms are increasingly pressured to manage their supply chain right. Thus, supply chain management has

become the forefront of the firms' competitive strategy. The discipline of supply chain management, however, is still undergoing an evolutionary process. Table 1.1 summarizes the changes in the philosophy, focus, and performance metrics of supply chain management, from the earlier stages to the current era (see Martin and Towill, 2000).

**Table 1.1.** The Evolution of Supply Chain Management Disciplines

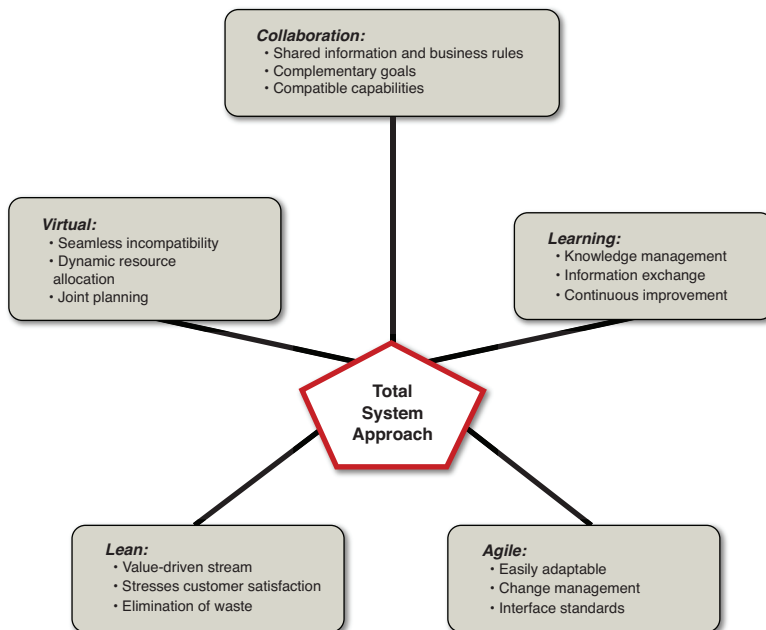
Evolution Stage	Time Period	Philosophy	Key Driver	Key Performance Metric
I	Early 1980s	Product driven	Quality	<ul style="list-style-type: none"> <li>• Inventory turns</li> <li>• Production cost</li> </ul>
II	Late 1980s	Volume driven	Cost	<ul style="list-style-type: none"> <li>• Throughput</li> <li>• Production capacity</li> </ul>
III	Early 1990s	Market driven	Product availability	<ul style="list-style-type: none"> <li>• Market share</li> <li>• Order fill rate</li> </ul>
IV	Late 1990s	Customer driven	Lead time	<ul style="list-style-type: none"> <li>• Customer satisfaction</li> <li>• Value added</li> <li>• Response time</li> </ul>
V	Early twenty-first century	Knowledge driven	Information	<ul style="list-style-type: none"> <li>• Real-time communication</li> <li>• Business intelligence</li> </ul>

## Total Systems Approach and Boundary Spanning

A traditional business paradigm intends to react to unforeseen customer demand on a “push” basis by building buffers such as inventory that mitigate forecasting errors and hide distribution/production planning problems. The traditional business paradigm is also characterized by the sequential flow of information from one business function to another. Because the sequential information flow does not give an organization the opportunity to synchronize its functional activities and will impair its visibility throughout the planning processes, the same hidden problems will recur and the vicious cycle of inefficiency will continue without the problems ever being addressed. The best way to break this vicious cycle is to create a system that allows the organization to see the big picture of the business processes and then analyze the impact of the whole business processes on the organizational-wide goals rather than the departmental/functional goals. In other words, to continuously improve business processes, the traditional business paradigm should be replaced by the total system approach, which can create a whole greater than the sum of its parts. Therefore, the total systems approach is considered a major foundation for the supply chain concept.

The total systems approach regards the supply chain as an entity that is composed of interdependent or interrelated subsystems, each with its own provincial goals, but which integrates the activities of each segment so as to optimize the system-wide strategic objectives. To elaborate, the total systems approach is referred to as a “holistic, integrated approach” whereby all the business processes involving demand planning, purchasing, production, transportation, warehousing, and marketing are coordinated to make the best tradeoffs within them so as to achieve the optimal outcome for the whole system. For instance, the decision to increase inventory to make products more readily available to customers will help promote sales, but it would incur higher inventory carrying costs and warehousing costs. Without understanding such interdependence of the decision-making processes within the supply chain, the organization as a whole will continue to suffer from the downward spiral of declining productivity. That is to say, the total systems approach recognizes the fact that a decision made in one of the business functions can impact other functions of the organization. As such, the total systems approach enables the firm to assess how changes in business strategy and decisions affect the firm’s across-the-board total costs and benefits.

The total systems approach to supply chain integration is often predicated on the five essential attributes displayed in Figure 1.3 (Miller and Berger, 2001, p. 13). As shown in this figure, collaboration is at the center of the total systems approach.



**Figure 1.3.** *The five essentials of the total systems approach to supply chain integration*



As the extended enterprise perspective brought by the total systems approach has become the important foundation of supply chain thinking, we have witnessed increasing boundary-spanning activities across the supply chain. Typically, these boundary-spanning activities have played three different roles:

- **Gatekeeping**—They single out potential suppliers and third-party logistics providers through a request for proposal (RFP) and then help the firm to make an informed decision as to who will be selected as the supply chain partner among a managerial list of candidates.
- **Transacting**—They develop all aspects of business trading opportunities with the potential supply chain partners on an equal footing.
- **Protecting**—They ensure conformance with contract terms and conditions, delivery schedules, product/service quality, and other partnership agreements (see Davis and Spekman, 2004, for details of boundary spanning roles).

## Conceptual Foundations of Demand Chain, Value Chain, and Supply Chain

Although supply chain management has been hailed as an innovative way to compete in today's business world, its concept created a lot of confusion, as evidenced by the presence of more than 2,000 different definitions of supply chain management (see Gibson et al., 2005). Adding to the confusion, the term *supply chain* was often interchangeably used with *demand chain* and *value chain*. Therefore, it is important for us to synthesize these terms and differentiate among them when appropriate.

Because the ultimate goal of supply chain management is to serve the customer better, supply chain management begins with the understanding of customer values and requirements. Indeed, Poirier (1999) argued that the primary objective of supply chain improvements was to serve ultimate customers more effectively and therefore an analysis of the supply chain should focus on the “finish line” (demand), not the “starting point” (supply). To enhance the customer values and meet customer requirement, careful planning of demand-creation and -fulfillment activities is critical to the success of the whole organization. This planning cannot be articulated without understanding the dynamics of interrelated business activities and jointly developing ideas for business process improvement among the intra- and inter-organizational units. Therefore, any efforts geared toward the customer-centric and “pull” approach throughout the entire business processes are considered part of the demand chain.

In a context similar to the demand chain, a *value chain* is referred to as a series of interrelated business processes that create and add value for customers. Its intent is to

disaggregate all of a firm's business processes into discrete activities to evaluate their level of contributions to the firm's value and then discern value-adding activities from non-value-adding activities. Herein, "value is the amount buyers are willing to pay for what a firm provides them and thus is measured by total revenue, a reflection of the price a firm's product commands and the units it can sell" (Porter, 1985, p. 38). Thus, the extent of value created and added by the firm often dictates its level of business success, because the higher the value, the greater the profit margin and competitive advantages.

As shown in Figure 1.3, the value chain focuses on the customer's value by connecting the customer's needs to every aspect of the value-adding business activities encompassing sourcing, manufacturing, logistics, and marketing across the organizational boundary. The value chain is often driven by four key imperatives (Bovet, 1999):

- **Reduced uncertainty**, which minimizes asset intensity through the reduction and elimination of inventory
- **Increased speed**, which minimizes the risk of obsolescence
- **Increased revenue** resultant from the maximization of customization and the subsequent customer loyalty
- **Increased productivity** through multiple asset productivity

Although Table 1.2 shows that the strategic focus and perspectives of the demand chain, the value chain, and the supply chain are somewhat different from one another as described by Sherman (1998, p 2), their fundamental concepts and ultimate goals are not distinctively different in that all these concepts are customer-centric and stress the importance of coordinated linkage between business activities to the firm's competitiveness. Therefore, these three terms can be regarded as synonyms. To put it simply, the supply chain originates at the sources of supply and flows toward the customer, whereas the demand chain flows backward from the customer and ends up with the enterprise. The value chain is created when the supply chain is in sync with the demand chain. Regardless of the semantic differences, the supply chain benefit may be maximized by following the seven principles outlined by Copacino (1997):

- *Understand the customer values and requirements* so that the firm can identify how to align its operations to meet its customers' requirements and needs.
- *Manage logistics assets* such as warehouses, terminals, transportation equipment, and pipeline inventory across the supply chain with the help of both the downstream and upstream supply chain partners.
- *Organize the customer management* in such a way that the firm can provide a single point of contact to the customer for information and post-sales follow-ups.