



NORTH-HOLLAND

Issues in Supply Chain Management

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Successful supply chain management requires cross-functional integration and marketing must play a critical role. The challenge is to determine how to successfully accomplish this integration. We present a framework for supply chain management as well as questions for how it might be implemented and questions for future research. Case studies conducted at several companies and involving multiple members of supply chains are used to illustrate the concepts described. © 2000 Elsevier Science Inc. All rights reserved.

INTRODUCTION

One of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. Business management has entered the era of internetwork competition. Instead of brand versus brand or store versus store, it is now suppliers—brand—store versus suppliers—brand—store, or supply chain

versus supply chain. In this emerging competitive environment, the ultimate success of the single business will depend on management's ability to integrate the company's intricate network of business relationships [1–3].

Increasingly, the management of multiple relationships across the supply chain is being referred to as supply chain management (SCM). Strictly speaking, the supply chain is not a chain of businesses with one-to-one, business-to-business relationships, but a network of multiple businesses and relationships. SCM offers the opportunity to capture the synergy of intra- and intercompany integration and management. In that sense, SCM deals with total business process excellence and represents a new way of managing the business and relationships with other members of the supply chain.

Thus far, there has been relatively little guidance from academia, which in general has been following, rather than leading, business practice [4–6]. There is a need for building theory and developing normative tools and methods for successful SCM practice. The exploratory empirical findings reported here are part of a research effort to develop a normative model to guide future research. Executives can use the model to capture the potential of successful SCM.

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Supply chain management (SCM) is a new way of managing the business and its relationships.

The Global Supply Chain Forum (GSCF), a group of non-competing firms and a team of academic researchers, has been meeting regularly for the past 6 years with the objective to improve the theory and practice of SCM. The definition of SCM as developed and used by The GSCF is as follows:¹

Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.

This broader understanding of the SCM concept is illustrated in Figure 1, which depicts a simplified supply chain network structure; the information and product flows; and the key supply chain business processes penetrating functional silos within the company and the vari-

ous corporate silos across the supply chain. Thus, business processes become supply chain business processes linked across intra- and intercompany boundaries.

This paper is organized as follows: First, there is a brief literature review relating SCM to logistics and to marketing channels research. The case methodology that provides the basis for our findings is described. Next, we report some of the findings and key issues related to each of the three elements of the SCM framework. For simplicity, each element will be dealt with separately; although, in practice, they are closely interrelated. Issues regarding how to map business processes across the supply chain are briefly described. Finally, suggestions for future research and conclusions are outlined [7–9].

LITERATURE REVIEW

SCM has received considerable attention in the popular business press and in some academic literatures. This section is divided into two parts. First, the emergence of SCM from the logistics literature is described. Then, selected marketing literature is related to the SCM concept.

SCM versus Logistics

The term *SCM* was originally introduced by consultants in the early 1980s [10] and has subsequently gained tremendous attention [11]. Since the early 1990s, academics have attempted to give structure to SCM [12–14]. Bechtel and Jayaram [15] identified generic schools of SEM thought and the major contributions from the literature. They also identified fundamental assumptions of SCM that must be challenged in the future.

Until recently, most practitioners [16–20], consultants [21–23], and academics [24–28] had viewed SCM not appreciably different from the contemporary understanding of logistics management, as defined by the Council

¹Previously the Research Roundtable of The International Center for Competitive Excellence, University of North Florida (UNF), Dr. Douglas M. Lambert, Director, 1994. In 1996, this group moved with Dr. Lambert to The Ohio State University (OSU) and became The Global Supply Chain Forum. Beginning in January 1999, the group is jointly involved with OSU and UNF.

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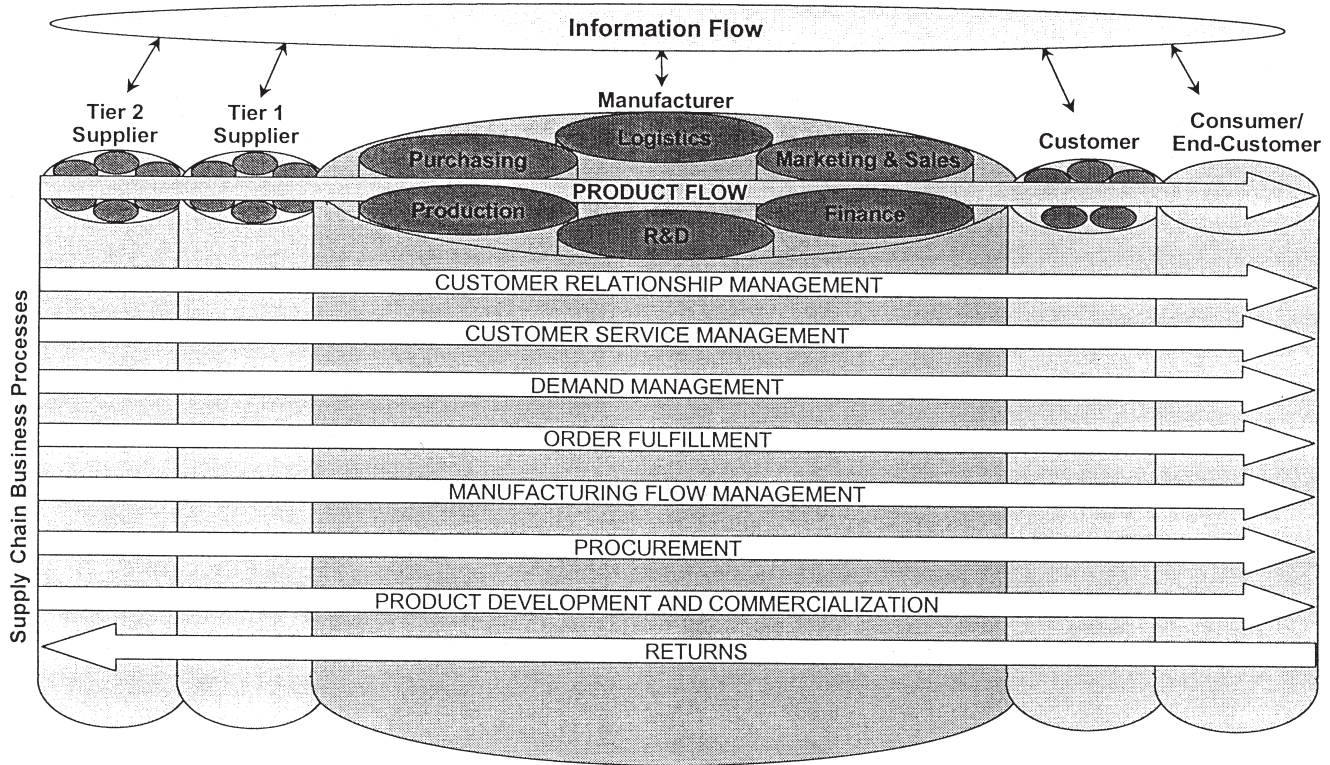


FIGURE 1. Supply chain management: integrating and managing business processes across the supply chain.
Source: [7, p. 10]

of Logistics Management (CLM) in 1986.² That is, SCM was viewed as logistics outside the firm to include customers and suppliers. Logistics, as defined by the CLM, always represented a supply chain orientation “from point of origin to point of consumption.” Then why the confusion? It is probably due to the fact that logistics is a functional silo within companies and is also a bigger concept that deals with the management of material and information flows across the supply chain. This is similar to the confusion over marketing as a concept and marketing as a functional area. Thus the quote from CEO: “Marketing is too important to be left to the marketing department.” Everybody in the company should have a customer focus. The marketing concept does not apply

just to the marketing department. It is everybody’s responsibility to focus on serving the customer’s needs.

The understanding of SCM has been re-conceptualized from integrating logistics across the supply chain to the current understanding of integrating and managing key business processes across the supply chain [5]. Based on this emerging distinction between SCM and logistics, in October 1998 CLM announced a modified definition of logistics. The modified definition explicitly declares CLM’s position that logistics management is only a part of SCM. The revised definition is as follows:

Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers’ requirements.³

Imagine the degree of complexity required to manage all suppliers back to the point of origin and all products/

² In 1986, the Council of Logistics Management, the leading-edge professional organization with a current membership of over 15,000, defined logistics management as: *The process of planning, implementing, and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods, and related information flow from point-of-origin to point-of-consumption for the purpose of conforming to customer requirements. What’s It All About?* Council of Logistics Management, Oak Brook, Illinois, 1986.

³ Presented at the annual business meeting, Council of Logistics Management (CLM), in Anaheim, California, in October 1998. The definition is posted at the CLM’s homepage at <http://www.CLM1.org>.

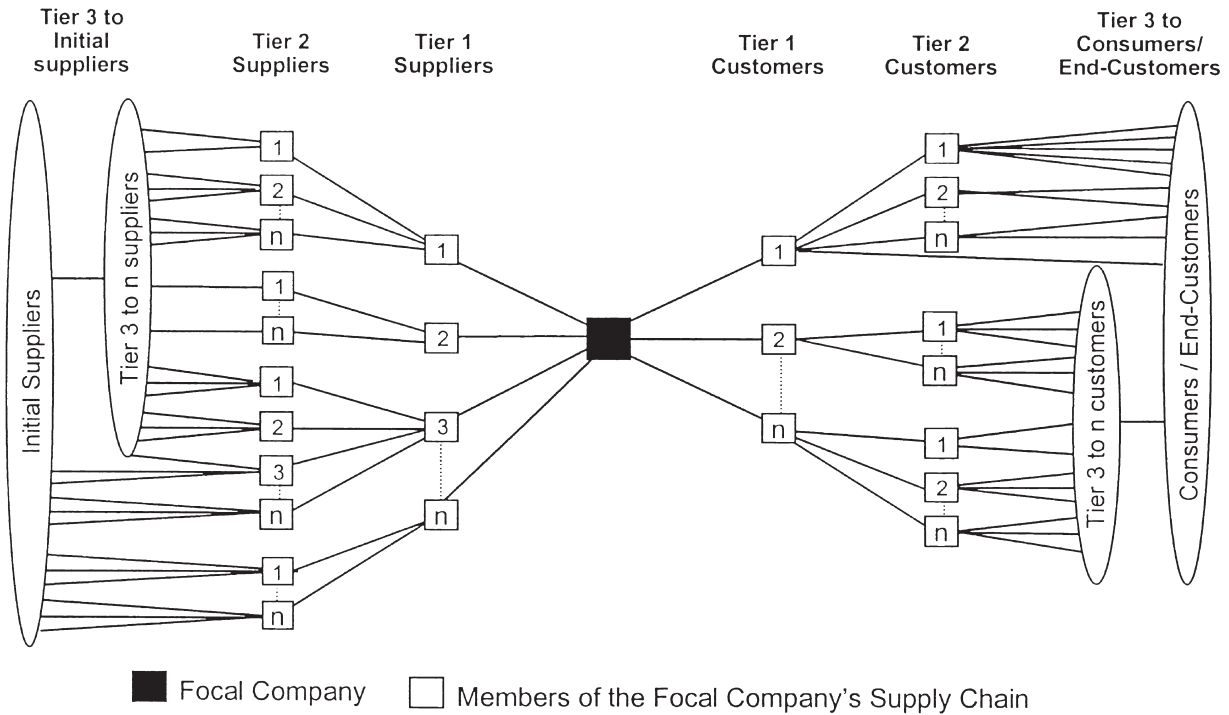


FIGURE 2. Supply chain network structure. Source: [8, p. 3]

services out to the point of consumption. It is probably easier to understand why executives would want to manage their supply chains to the point of consumption, because whoever has the relationship with the end user has the power in the supply chain. Intel created a relationship with the end user by having computer manufacturers place an “intel inside” label on their computers. This affects the computer manufacturer’s ability to switch microprocessor suppliers. But managing all tier-1 suppliers’ networks to the point of origin is an enormous undertaking. Managing the entire supply chain is a very difficult and challenging task, as illustrated in Figure 2.

Marketing Perspective

Early marketing channel researchers such as Wroe Alderson and Louis P. Bucklin conceptualized the key factors for why and how channels are created and structured [29–31]. From a supply chain standpoint, these researchers were on the right track in the areas of: 1) identifying who should be a member of the marketing channel, 2) describing the need for channel coordination, and 3) drawing actual marketing channels. However, for the last 30 years many channels researchers ignored two critical issues. First, they did not build on the early contributions

by including suppliers to the manufacturer and thus neglected the importance of a total supply chain perspective. Second, they focused on marketing activities and flows across the channel and overlooked the need to integrate and manage multiple key processes within and across companies. More recently, Webster [32] challenged marketers and marketing researchers to consider relationships with multiple firms. He also called for cross-functional consideration in strategy formulation.

Unlike the marketing channels literature, a major weakness of much of the SCM literature is that the authors appear to assume that everyone knows who is a member of the supply chain. There has been little effort to identify specific supply chain members, key processes that require integration or what management must do to successfully manage the supply chain.

METHODOLOGY

In order to better understand SCM, a case-study approach is used involving the supply chains of members of The GSCF. Thus far, over 90 in-depth interviews, in 15 companies covering 9 different supply chains, have been conducted with managers representing various levels,

Managing a supply chain is a difficult task.

functions, and processes. The processes covered in the interviews included customer relationship management, customer service management, demand management, order fulfillment, procurement, and product development and commercialization. The functions represented by those interviewed included marketing/sales, logistics, manufacturing, information systems, finance, quality management, and strategic planning. The interviews were conducted using a 36-question interview guide, which was developed based upon our previous work, a review of the literature, and discussions with members of The GSCF. The interviews were conducted in person, ranged from 1 to 3 hours, and were recorded and transcribed for analysis.

A CONCEPTUAL FRAMEWORK OF SCM

The conceptual framework emphasizes the interrelated nature of SCM and the need to proceed through several steps to design and successfully manage a supply chain. The SCM framework consists of three closely interrelated elements: the supply chain network structure, the supply chain business processes, and the supply chain management components (Figure 3).

The supply chain network structure consists of the member firms and the links between these firms. Business processes are the activities that produce a specific output of value to the customer. The management components are the managerial variables by which the business processes are integrated and managed across the supply chain. Each of the three interrelated elements that constitute the framework is now described.

Supply Chain Network Structure

All firms participate in a supply chain, from the raw materials to the ultimate consumer. How much of this supply chain needs to be managed depends on several factors including the complexity of the product, the number of available suppliers, and the availability of raw materials. Dimensions to consider include the length of the supply chain and the number of suppliers and customers at

each level. It would be rare for a firm to participate in only one supply chain. For most manufacturers, the supply chain looks less like a pipeline or chain than an uprooted tree, where the branches and roots are the extensive network of customers and suppliers [33]. The question is how many of these branches and roots need to be managed.

The closeness of the relationship at different points in the supply chain will differ. Management will need to choose the level of partnership appropriate for particular supply chain links [34]. Not all links throughout the supply chain should be closely coordinated and integrated. The most appropriate relationship is the one that best fits the specific set of circumstances [35]. Determining which parts of the supply chain deserve management attention must be weighed against firm capabilities and the importance to the firm.

It is important to have an explicit knowledge and understanding of how the supply chain network structure is configured. We suggest that the three primary aspects of a company's network structure are: (1) the members of the supply chain, (2) the structural dimensions of the network, and (3) the different types of process links across the supply chain. Each issue is now addressed.

IDENTIFYING SUPPLY CHAIN MEMBERS. When determining the network structure, it is necessary to identify who the members of the supply chain are. Including all types of members may cause the total network to become highly complex, since it may explode in the number of members added from tier level to tier level [33]. To integrate and manage all process links with all members across the supply chain would, in most cases, be counterproductive, if not impossible. The key is to sort out some basis for determining which members are critical to the success of the company and the supply chain and, thus, should be allocated managerial attention and resources.

Marketing channels researchers identified members of the channel based on who partakes in the various marketing flows including product, title, payment, information, and promotion flows [36]. Each flow included relevant members, such as banks for the payment flow and advertising agencies for the promotion flow. The channel researchers sought to include all members partaking in the

The supply chain looks less like a pipeline or chain than an uprooted tree.

marketing flows, regardless of how much impact each member had on the value provided to the end customer or other stakeholders.

The members of a supply chain include all companies/organizations with whom the focal company interacts directly or indirectly through its suppliers or customers, from point of origin to point of consumption. However, to make a very complex network more manageable, it seems appropriate to distinguish between primary and supporting members. The definitions of primary and supporting members are based on our interviews, discussions with the members of The GSCF, and by applying the definition of a business process by Davenport [37]. We define primary members of a supply chain to be *all*

those autonomous companies or strategic business units who carry out value-adding activities (operational and/or managerial) in the business processes designed to produce a specific output for a particular customer or market.

In contrast, supporting members are *companies that simply provide resources, knowledge, utilities, or assets for the primary members of the supply chain*. For example, supporting companies include those that lease trucks to the manufacturer, banks that lend money to a retailer, the owner of the building that provides warehouse space, or companies that supply production equipment, print marketing brochures, or provide temporary secretarial assistance. These supply chain members support the pri-

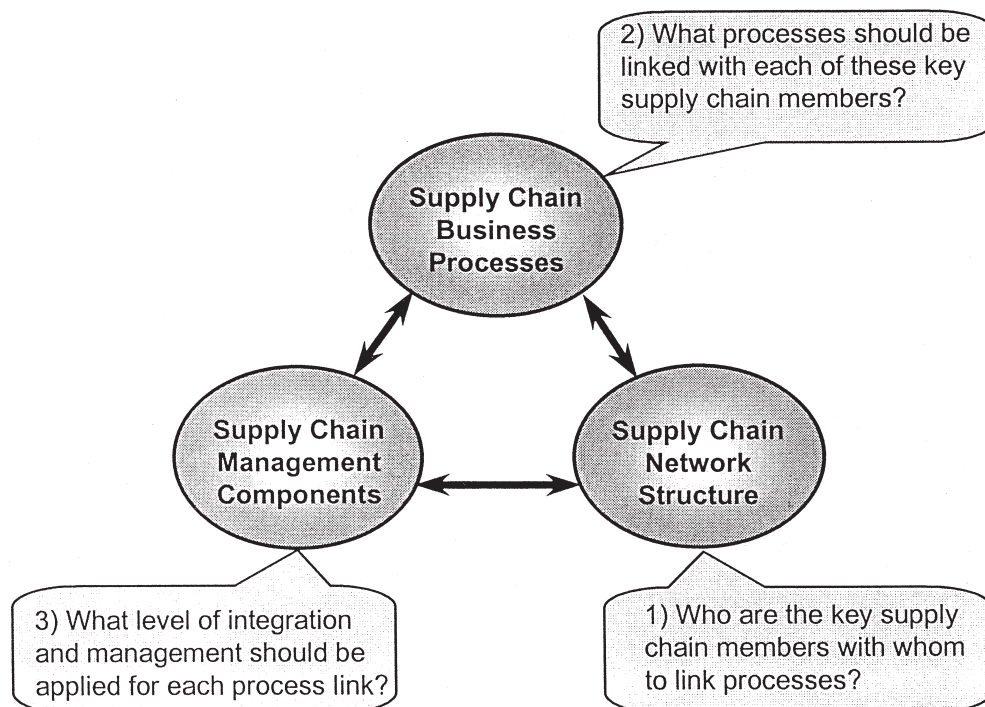


FIGURE 3. Supply chain management framework: elements and key decisions [7].

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes.

mary members now and will continue to do so in the future.

The same company can perform both primary and supportive activities. Likewise, the same company can perform primary activities related to one process and supportive activities related to another process. An example from one of the case studies is an original equipment manufacturer (OEM) that buys some critical and complex production equipment from a supplier. When the OEM develops new products, it works very closely with the equipment supplier to assure that the right equipment is available to make the new product. Thus, the supplier is a primary member of the OEM's product development process. However, once the machinery is in place, the supplier is a supportive, not a primary, member for the manufacturing flow management process. This is because supplying the equipment does not in itself add value to the output of the process, even though the equipment itself adds value.

It should be noted that the distinction between primary and supporting supply chain members is not obvious in all cases. Nevertheless, we believe that this distinction provides a reasonable managerial simplification and yet captures the essential aspects of who should be considered as key members of the supply chain. The approach for differentiating between types of members is to some extent similar to how Porter distinguishes between primary and support activities in his "value chain" framework [38].

The definitions of primary and supporting members make it possible to define the point of origin and the point of consumption of the supply chain. The point of origin of the supply chain occurs where no previous primary suppliers exist. All suppliers to the point of origin members are solely supporting members. The point of

consumption is where no further value is added, and the product and/or service is consumed.

THE STRUCTURAL DIMENSIONS OF THE NETWORK. Three structural dimensions of the network are essential when describing, analyzing, and managing the supply chain. These dimensions are the horizontal structure, the vertical structure, and the horizontal position of the focal company within the end points of the supply chain.

The first dimension, *horizontal structure*, refers to the number of tiers across the supply chain. The supply chain may be long, with numerous tiers, or short, with few tiers. As an example, the network structure for bulk cement is relatively short. Raw materials are taken from the ground, combined with other materials, moved a short distance, and used to construct buildings. The second dimension, *vertical structure*, refers to the number of suppliers/customers represented within each tier. A company can have a narrow vertical structure, with few companies at each tier level, or a wide vertical structure with many suppliers and/or customers at each tier level. The third structural dimension is the company's *horizontal position* within the supply chain. A company can be positioned at or near the initial source of supply, be at or near to the ultimate customer, or somewhere between these end points of the supply chain.

In the companies studied, different combinations of these structural variables were found. In one example, a narrow and long network structure on the supplier side was combined with a wide and short structure on the customer side. Increasing or reducing the number of suppliers and/or customers will affect the structure of the supply chain. For example, as some companies move from multiple- to single-source suppliers, the supply chain may become narrower. Outsourcing logistics, manufacturing, marketing, or product development activities is

The supply chain has multiple processes.

another example of decision-making that will likely change the supply chain structure. It may increase the length and width of the supply chain and, likewise, influence the horizontal position of the focal company in the supply chain network.

Supply chains that burst to many tier-1 customers/suppliers will strain the resources for how many process links the focal company can integrate and closely manage beyond tier 1. In general, we found that companies with immediately wide vertical structures actively managed only a few tiers of customers or suppliers. Some of the companies studied have transferred servicing small customers to distributors, thus moving the small customers further down in the supply chain from the focal company. This principle, known as functional spin-off, is described in the channel's literature [36] and can be applied to the focal company's network of suppliers.

The supply chains we studied looked different from each company's perspective, since management of each company sees its firm as the focal company and views membership and network structure differently. However, because each firm is a member of the other's supply chain, it is important for management of each firm to understand their interrelated roles and perspectives. The reason for this is that the integration and management of business processes across company boundaries will be successful only if it makes sense from each company's perspective [33].

Supply Chain Business Processes⁴

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. Traditionally, both upstream and downstream portions of the supply chain have interacted as disconnected entities receiving sporadic flows of information over time.

The purchasing department placed orders as requirements became necessary and marketing, responding to customer demand, interfaced with various distributors and retailers and attempted to satisfy this demand. Orders were periodically given to suppliers and their suppliers had no visibility at the point of sale or use. Satisfying the customer often translated into demands for expedited operations throughout the supply chain as member firms reacted to unexpected changes in demand.

Operating an integrated supply chain requires continuous information flows, which in turn help to create the best product flows. The customer remains the primary focus of the process. Achieving a good customer-focused system requires processing information both accurately and in a timely manner for quick response systems that require frequent changes in response to fluctuations in customer demand. Controlling uncertainty in customer demand, manufacturing processes, and supplier performance are critical to effective SCM.

In many major corporations, such as 3M, management has reached the conclusion that optimizing the product flows cannot be accomplished without implementing a process approach to the business. The key supply chain processes identified by members of The GSCF are:

- Customer relationship management
- Customer service management
- Demand management
- Order fulfillment
- Manufacturing flow management
- Procurement
- Product development and commercialization
- Returns.

These processes are shown in Figure 1. Each of the eight processes are now be described.

CUSTOMER RELATIONSHIP MANAGEMENT PROCESS. The first step toward integrated SCM is to identify key customers or customer groups, which the organization targets as critical to its business mission. Product and service agreements specifying the levels of performance are established with these key customer groups. Customer service teams work with customers to further identify and eliminate sources of demand variability. Performance

⁴This material is adapted from Lambert, D. M., Guinipero, L. C., and Ridenhower, G. J.: Supply Chain Management: A Key to Achieving Business Excellence in the 21st Century, unpublished manuscript as reported in Lambert, D. M., Stock, J. R., and Ellram, L. M.: *Fundamentals of Logistics Management*. Irwin/McGraw-Hill, Burr Ridge, Illinois, 1998. All rights reserved.

The importance of corporate culture and its compatibility across in supply chains cannot be underestimated.

evaluations are undertaken to analyze the levels of service provided to customers as well as customer profitability.

CUSTOMER SERVICE MANAGEMENT PROCESS. Customer service provides the single source of customer information. It becomes the key point of contact for administering the product/service agreement. Customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the organizations' production and distribution operations. Finally, the customer service group must be able to assist the customer with product applications.

DEMAND MANAGEMENT PROCESS. Hewlett-Packard's experience with SCM indicates that inventory is either essential- or variability-driven [16]. Essential inventory includes work-in-process in factories and products in the pipeline moving from location to location. Variability stock is present due to variance in process, supply, and demand. Customer demand is by far the largest source of variability and it stems from irregular order patterns. Given this variability in customer ordering, demand management is a key to effective SCM.

The demand management process must balance the customer's requirements with the firm's supply capabilities. Part of managing demand involves attempting to determine what and when customers will purchase. A good demand management system uses point-of-sale and "key" customer data to reduce uncertainty and provide efficient flows throughout the supply chain. Marketing requirements and production plans should be coordinated on an enterprise-wide basis. Thus, multiple sourcing and routing options are considered at the time of order receipt, which allows market requirements and production plans to be coordinated on an organization-wide basis. In very advanced applications, customer demand and production rates are synchronized to manage inventories globally.

CUSTOMER ORDER FULFILLMENT PROCESS. The key to effective SCM is meeting customer need dates. It is important to achieve high order-fill rates either on a line item or order basis. Performing the order fulfillment process effectively requires integration of the firm's manufacturing, distribution, and transportation plans. Alliances should be developed with key supply chain members and carriers to meet customer requirements and reduce total delivered cost to the customer. The objective is to develop a seamless process from the supplier to the organization and then on to its various customer segments.

MANUFACTURING FLOW MANAGEMENT PROCESS. The manufacturing process in make-to-stock firms traditionally produced and supplied products to the distribution channel based on historical forecasts. Products were pushed through the plant to meet a schedule. Often the wrong mix of products was produced resulting in unneeded inventories, excessive inventory carrying costs, mark downs, and transshipments of product.

With SCM, product is pulled through the plant based on customer needs. Manufacturing processes must be flexible to respond to market changes. This requires the flexibility to perform rapid changeover to accommodate mass customization. Orders are processed on a just-in-time (JIT) basis in minimum lot sizes. Production priorities are driven by required delivery dates. At 3M, manufacturing planners work with customer planners to develop strategies for each customer segment. Changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness to customers.

PROCUREMENT PROCESS. Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products. Suppliers are categorized based on several dimensions, such as their contribution and criticality to the organization. In companies where operations extend worldwide, sourcing should be managed on a global basis.

Managing the supply chain cannot be left to chance.

Long-term strategic alliances are developed with a small core group of suppliers. The desired outcome is a win-win relationship, where both parties benefit. This is a change from the traditional bid-and-buy system to involving a key supplier early in the design cycle, which can lead to dramatic reduction in product development cycle times. Having early supplier input reduces time by getting the required coordination between engineering, purchasing, and the supplier prior to design finalization.

The purchasing function develops rapid communication mechanisms such as electronic data interchange (EDI) and Internet linkages to quickly transfer requirements. These rapid communication tools provide a means to reduce time and cost spent on the transaction portion of the purchase. Purchasers can focus their efforts on managing suppliers as opposed to placing orders and expediting. This also has implications for the role of the sales force when orders are not placed through the sales person.

PRODUCT DEVELOPMENT AND COMMERCIALIZATION. If new products are the lifeblood of a corporation, then product development is the lifeblood of a company's new products. Customers and suppliers must be integrated into the product development process in order to reduce time to market. As product life cycles shorten, the right products must be developed and successfully launched in ever shorter timeframes in order to remain competitive.

Managers of the product development and commercialization process must:

- Coordinate with customer relationship management to identify customer- articulated and -unarticulated needs
- Select materials and suppliers in conjunction with procurement
- Develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

RETURNS PROCESS. Managing returns as a business process offers the same opportunity to achieve a sustain-

able competitive advantage as does managing the supply chain from an outbound perspective [39]. In many countries, this may be an environmental issue, but not always. Effective process management of returns enables identification of productivity improvement opportunities and breakthrough projects.

At Xerox, returns are managed in four categories: equipment, parts, supplies, and competitive trade-ins. "Return to available" is a velocity measure of the cycle time required to return an asset to a useful status. This metric is particularly important for those products where customers are given an immediate replacement in the case of product failure. Also, equipment destined for scrap and waste from manufacturing plants is measured in terms of the time until cash is received.

Types of Business Process Links

As noted earlier, integrating and managing all business process links throughout the entire supply chain is likely not appropriate. Since the drivers for integration are situational and different from process link to process link, the levels of integration should vary from link to link, and over time. Some links are more critical than others [40]. As a consequence, the task of allocating scarce resources among the different business process links across the supply chain becomes crucial. Our research indicates that four fundamentally different types of business process links can be identified between members of a supply chain. These are: managed business process links, monitored business process links, not-managed business process links, and not-member business process links.

MANAGED PROCESS LINKS. Managed process links are links that the focal company finds important to integrate and manage. In the supply chain drawn in Figure 4, the managed process links are indicated by the thickest solid lines. The focal company will integrate and manage process links with tier 1 customers and suppliers. As indicated by the remaining thick solid lines in Figure 4, the focal company is actively involved in the management of a number of other process links beyond tier 1.

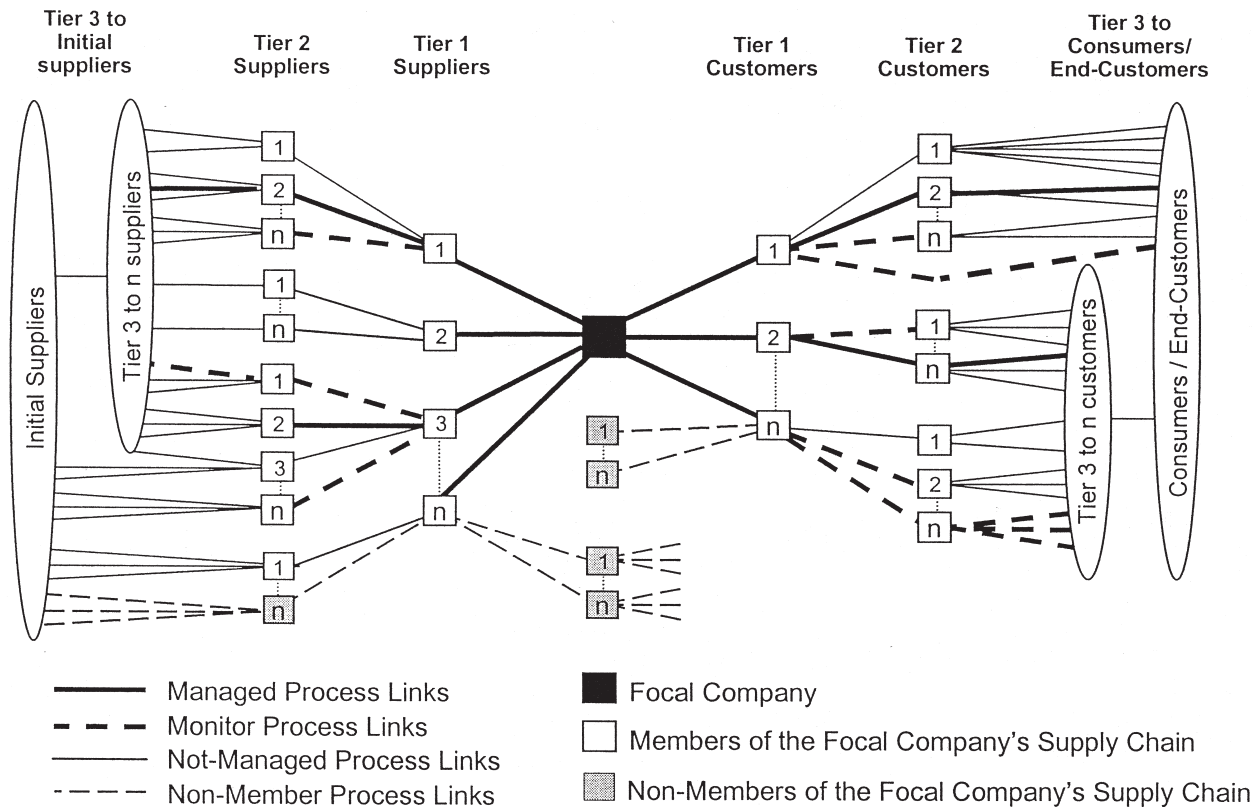


FIGURE 4. Types of intercompany business process links [8, p. 7].

MONITORED PROCESS LINKS. Monitored process links are not as critical to the focal company. However, it is important to the focal company that these process links are integrated and managed appropriately between the other member companies. Thus, the focal company, as frequently as necessary, simply monitors or audits how the process link is integrated and managed. The thick dashed lines in Figure 4 indicate the monitored process links.

NOT-MANAGED PROCESS LINKS. Not-managed process links are links that the focal company is not actively involved in, nor are they critical enough to use resources for monitoring. In other words, the focal company fully trusts the other members to manage the process links appropriately, or because of limited resources, leaves it up to them. The thin solid lines in Figure 4 indicate the not-managed process links. For example, a manufacturer has a number of potential suppliers for cardboard shipping cartons. Usually the manufacturer will not choose to integrate and manage the links beyond the cardboard supplier all the way back to the growing of the trees. The manufacturer wants certainty of supply, but it may not be necessary to integrate and manage the links beyond the cardboard supplier.

NON-MEMBER PROCESS LINKS. The case studies clearly indicated that managers are aware that their supply chains are influenced by decisions made in other connected supply chains. For example, a supplier to the focal company is also a supplier to the chief competitor, which may have implications for the supplier's allocation of manpower to the focal company's product development process, availability of products in times of shortage, and/or protection of confidentiality of information. Non-member process links are process links between members of the focal company's supply chain and non-members of the supply chain. Non-member links are not considered as links of the focal company's supply chain structure, but they can and often will affect the performance of the focal company and its supply chain. The thin dashed lines in Figure 4 illustrate examples of non-member process links.

Based on the process links just described, our research reveals variation in how closely companies integrate and manage links further away from the first tier. In some cases, companies work through or around other members/links in order to achieve specific supply chain objectives, such as product availability, improved quality, or

reduced overall supply chain costs. For example, a tomato ketchup manufacturer in New Zealand conducts research on tomatoes in order to develop plants that provide larger tomatoes with fewer seeds. Their contracted growers are provided with young plants in order to ensure the quality of the output. Since the growers tend to be small, the manufacturer further negotiates contracts with suppliers of equipment and supplies such as fertilizer and chemicals. The farmers are encouraged to purchase their raw materials and machinery using the contract rates. This results in higher quality raw materials and lower prices without sacrificing the margins and financial strength of the growers.

There are several examples of companies that, in times of shortage, discovered that it was important to manage beyond tier 1 suppliers for critical times. One example involves a material used in the manufacture of semiconductors. It turned out that the six tier 1 suppliers all purchased from the same tier 2 supplier. When shortages occurred, it became apparent that the critical relationship was with the tier 2 supplier. It is important to identify the critical links in the supply chain, and these may not be the immediately adjacent firms.

Business Process Chains

We have adopted Davenport's definition of a process as "a structured and measured set of activities designed to produce a specific output for a particular customer or market" [37]. A process can be viewed as a structure of activities designed for action with a focus on end customers and on the dynamic management of flows involving products, information, cash, knowledge, and/or ideas.

Thousands of activities are performed and coordinated within a company, and every company is, by nature, in some way involved in supply chain relationships with other companies [3, 41, 42]. When two companies build a relationship, certain activities will be linked and managed between the two companies [42]. Since both companies have linked some internal activities with other members of their supply chain, a link between two companies is thus a link in what might be conceived as a supply chain network. For example, the internal activities of a manufacturer are linked with and can affect the internal activities of a distributor, which in turn are linked with and can have an affect on the internal activities of a retailer. Ultimately, the internal activities of the retailer are

linked with and can affect the activities of the end customer.

The results of empirical research by Håkansson and Snehota stressed that "the structure of activities within and between companies is a critical cornerstone of creating unique and superior supply chain performance" [40]. In our study, the executives believed that competitiveness and profitability could increase if internal key activities and business processes are linked and managed across multiple companies. Thus, "Successful supply chain management requires a change from managing individual functions to integrating activities into key supply chain business processes" [43].

Our research indicated that in some companies, management emphasizes a functional structure, others a process structure, and others a combined structure of processes and functions. Those companies with processes had different numbers of processes consisting of different activities and links between activities. Different names were used for similar processes, and similar names for different processes. We believe that this lack of inter-company consistency is a cause for significant friction and inefficiencies in supply chains. At least with functional silos, there is generally an understanding of what functions like marketing, manufacturing, and accounting/finance represent. If each firm identifies its own set of processes, how can these processes be linked across firms? A simplified illustration of such a disconnected supply chain is shown in Figure 5.

The primary focus thus far has been on determining processes internal to the company. We have not yet addressed which processes are critical and/or beneficial to integrate and manage across the supply chain. As we attempted to draw the supply chains of the case study companies, it became clear that in some cases the internal business processes have been extended to suppliers and managed to some extent between the two firms involved. This may imply that when a leadership role is taken, a firm's internal business processes can become the supply chain business processes. The obvious advantage, when this is possible, is that each member of the band is playing the same tune.

The number of business processes that it is critical and/or beneficial to integrate and manage between companies will likely vary. In some cases, it may be appropriate to link just one key process and in other cases, it may be appropriate to link multiple or all of the key business processes. However, in each specific case, it is important that executives thoroughly analyze and discuss which

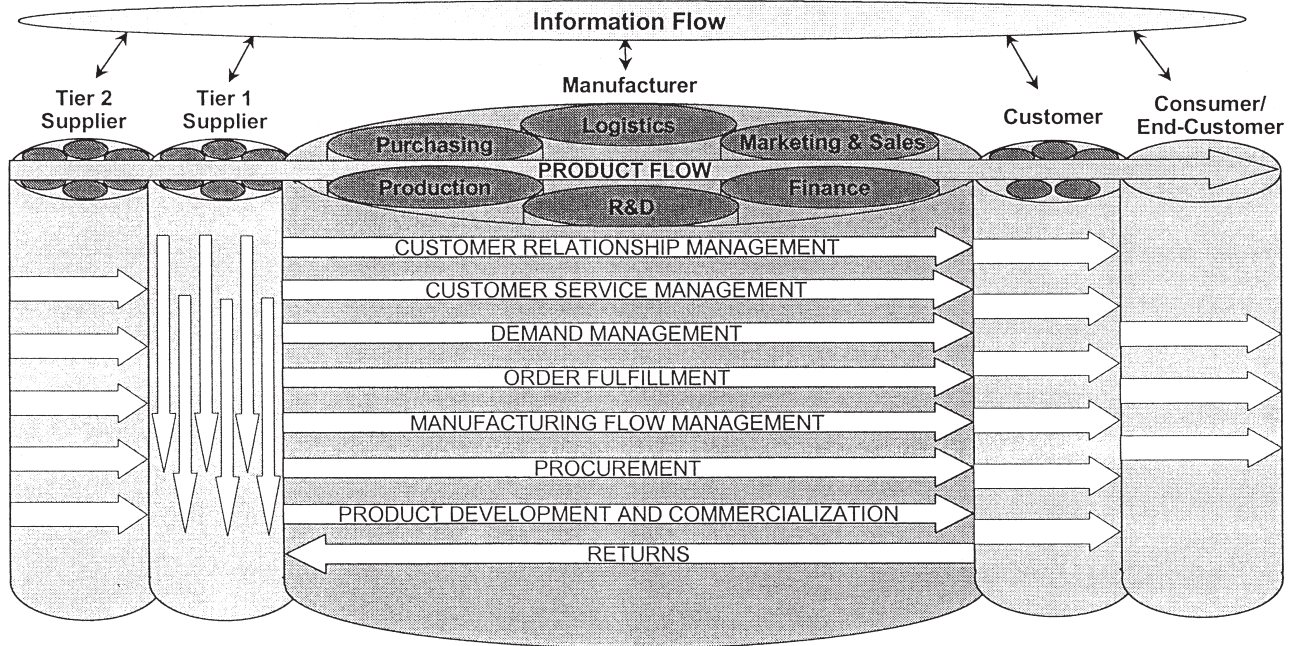


FIGURE 5. Supply chain management: the disconnects [8, p. 10].

key business processes to integrate and manage. The major components for integrating and managing a supply chain network are addressed next.

The Management Components of SCM

The SCM management components are the third element of the SCM framework (see Figure 3). The level of integration and management of a business process link is a function of the number and level, ranging from low to high, of components added to the link [46, 47]. Consequently, adding more management components or increasing the level of each component can increase the level of integration of the business process link.

The literature on business process reengineering [4, 48, 49], buyer—supplier relationships [12, 14, 46, 47], and SCM [7, 53–55] suggests numerous possible components that must receive managerial attention when managing supply relationships. Based on the management components identified in our previous work—review of the literature—and interviews with over 90 managers, we have identified the following nine management components for successful SCM: planning and control; work structure; organization structure; product flow facility structure; information flow facility structure; manage-

ment methods; power and leadership structure; risk and reward structure; and culture and attitude. These are briefly described below.

Planning and control of operations are keys to moving an organization or supply chain in a desired direction. The extent of joint planning is expected to bear heavily on the success of the supply chain. Different components may be emphasized at different times during the life of the supply chain but planning transcends the phases [14]. The control aspects can be operationalized as the best performance metrics for measuring supply chain success.

The *work structure* indicates how the firm performs its tasks and activities. The level of integration of processes across the supply chain is a measure of organizational structure. All, but one, of the literature sources that were examined cited work structure as an important component.

Organizational structure can refer to the individual firm and the supply chain; the use of cross-functional teams would suggest more of a process approach. When these teams cross organizational boundaries, such as in-plant supplier personnel, the supply chain should be more integrated.

Product flow facility structure refers to the network structure for sourcing, manufacturing, and distributing

across the supply chain. Since inventory is necessary in the system, some supply chain members may keep a disproportionate amount of inventory. As it is less expensive to have unfinished or semifinished goods in inventory than finished goods, upstream members may bear more of this burden. Rationalizing the supply chain network has implications for all members.

Virtually every author indicates that the *information flow facility structure* is key. The kind of information passed among channel members and the frequency of information updating has a strong influence on the efficiency of the supply chain. This may well be the first component integrated across part, or all, of the supply chain.

Management methods include the corporate philosophy and management techniques. It is very difficult to integrate a top-down organization structure with a bottom-up structure. The level of management involvement in day-to-day operations can differ across supply chain members.

The *power and leadership structure* across the supply chain will affect its form. One strong channel leader will drive the direction of the chain. In most chains studied to date, there are one or two strong leaders among the firms. The exercise of power, or lack thereof, can affect the level of commitment of other channel members. Forced participation will encourage exit behavior, given the opportunity [48, 49].

The anticipation of sharing of *risks and rewards* across the chain affects long-term commitment of channel members.

Culture and attitude are very important considerations. Compatibility of corporate culture across channel members cannot be underestimated. Meshing cultures and individuals' attitudes is time consuming, but it is necessary at some level in order for the channel to perform as a chain. Aspects of culture include how employees are valued and how they are incorporated into the management of the firm.

Figure 6 illustrates how the management components can be divided into two groups. The first group is the physical and technical group, which includes the most visible, tangible, measurable, and easy-to-change components. Our research, and much literature on change management [44, 45, 50, 51, 52], showed that if this group of management components is the only focus of managerial attention, then the results will be disappointing at best.

The second group is comprised of the managerial and behavioral components. These components are less tan-

gible and visible and are often difficult to assess and alter. The managerial and behavioral components define the organizational behavior and influence how the physical and technical management components can be implemented. If the managerial and behavioral components are not aligned to drive and reinforce an organizational behavior supportive to the supply chain objectives and operations, then the supply chain will likely be less competitive and profitable. If one or more components in the physical and technical group are changed, then management components in the managerial and behavioral group likewise may have to be readjusted. The groundwork for successful SCM is established by understanding each of these SCM components and their interdependence. Hewitt states that true intra- and intercompany business process management, or redesign, is only likely to be successful if it is recognized as a multi-component change process, simultaneously and explicitly addressing all SCM components [4].

We found all of the nine management components in the business process links that were studied. However, the number of components and combinations varied. The physical and technical components were well understood and managed the farthest up and down the supply chain. For example, in one case, the focal company had integrated its demand management process across four links by applying the following components: planning and control methods; work flow/activity structure; communication and information flow facility structure; and product flow facility structure. The managerial and behavioral management components were in general less well-understood, and more difficulties were encountered in their implementation. We only found one example of managerial and behavioral management components that were coordinated across more than one link of the supply chain.

MAPPING THE SUPPLY CHAIN

In the companies studied, the business processes were not linked across the same firms. In other words, different business processes had different looking supply chain network structures. An example is a focal company that involves supplier A, but not supplier B, in its product development process, whereas the demand management process is linked with both suppliers. Thus, we found that the companies choose to integrate and manage different supply chain links for different business processes.

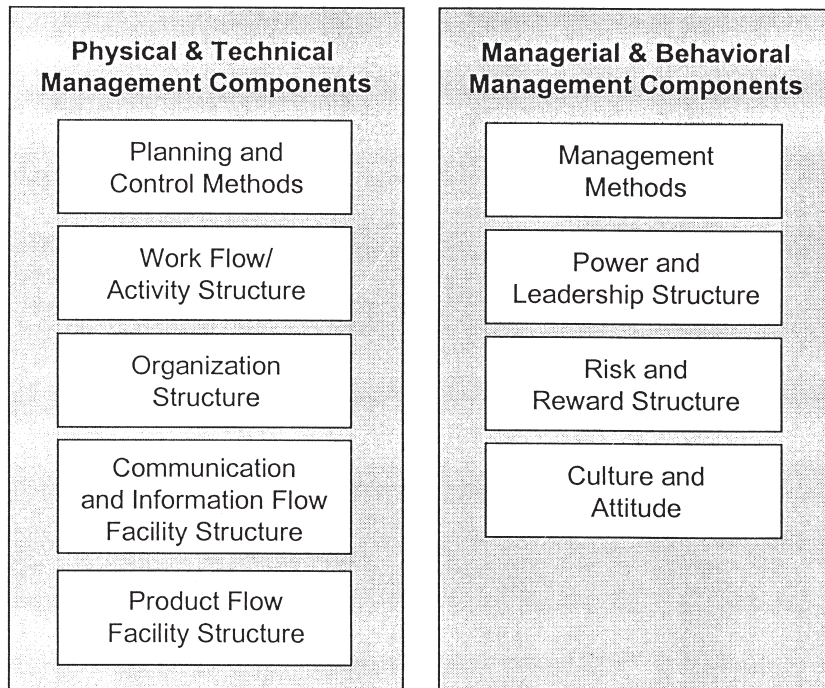


FIGURE 6. Supply chain management: fundamental management components [8, p. 12].

Figure 7 is an illustration of how the integrated and managed business process links of a focal company may differ from process to process. For simplicity, we have only illustrated the managed and not-managed business process links and, thus, omitted the monitored and non-

member process links. Also, we have only included very few supply chain members. The superimposed supply chains of four individual business process chains are shown in one diagram. We believe that it is necessary first to map individual processes and then superimpose

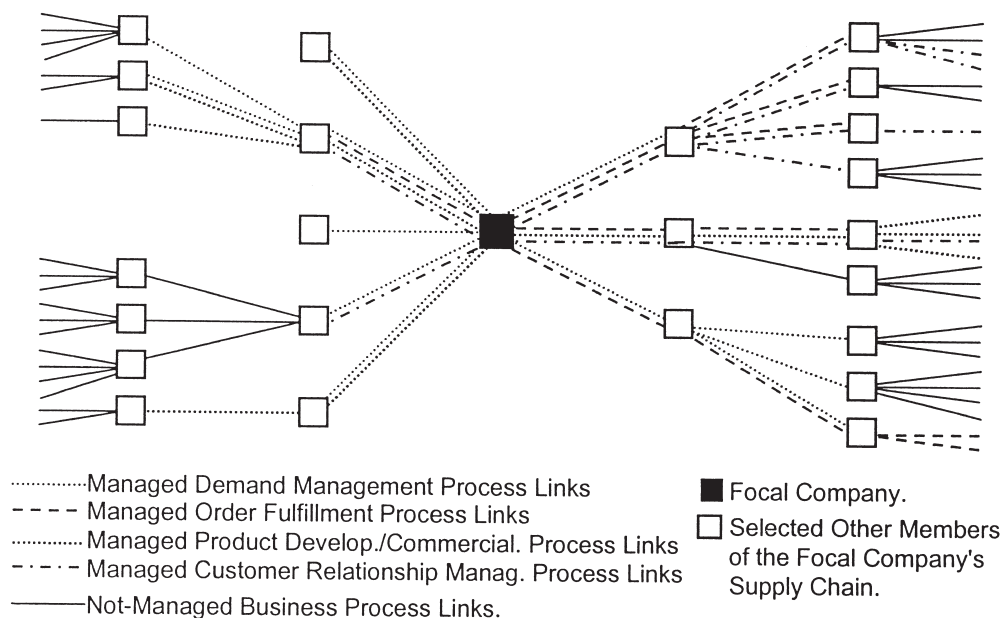


FIGURE 7. An illustration of a supply chain combining the integrated and managed business process links [8, p. 13].

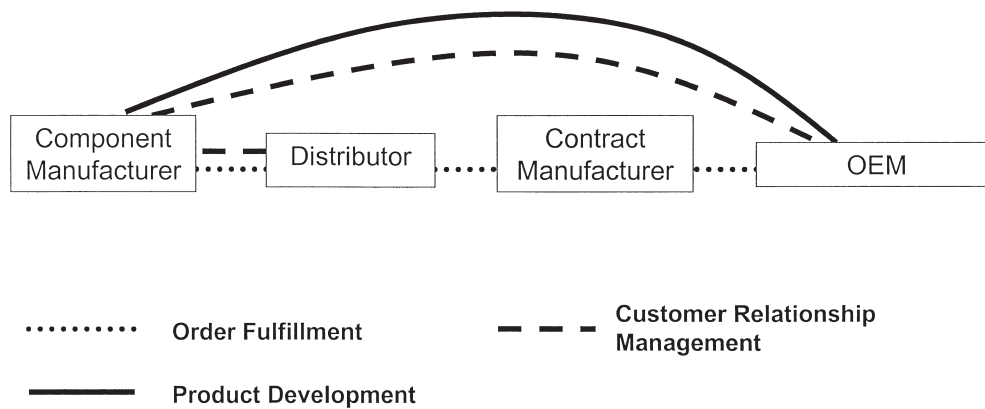


FIGURE 8. Network structure linkages for four tiers of a supply chain

them on one supply chain map. We suggest managers use this approach when mapping their supply chains.

Figure 8 displays an example from our research of how the supply chain linkages differ by process. Here, an OEM outsources its assembly and in-bound inventory activities to a contract manufacturer and a distributor, respectively. The distributor is responsible for having sufficient in-process inventory available to maintain production flow.

The component manufacturer's personnel manage customer relationships primarily with the OEM and the distributor (see dashed lines), although they sometimes visit the contract manufacturer to be sure that the components are performing as expected. The product development process for this part of the supply chain flows primarily from the OEM to the contract manufacturer (solid line) with the OEM's engineering team providing product specifications to the component manufacturer. Both of these processes link the component manufacture and the OEM as shown in Figure 8. Thus, the linkages do not always flow directly from the component manufacturer to the distributor to the contract manufacturer and finally to the OEM or vice versa. Only order fulfillment works this way, with product flow represented by the dotted line.

Previous literature has suggested that some or all business processes should be linked across the supply chain, from the initial source of supply to the ultimate end customer. In our research, there were no examples of this, nor were there any in the cases described in the literature. In fact, the companies that we studied had only integrated selected key process links, and were likewise only monitoring some other links.

SUGGESTIONS FOR FUTURE RESEARCH

A top priority should be research to develop a normative model that can guide managers in their efforts to develop and manage their supply chains. It is much easier to write a definition for SCM than it is to implement. Selected research opportunities include the following:

1. What are the operational definitions of the key business processes and what are the relationships among these processes? How do you obtain buy in from the functional areas in order to implement a process approach within the firm? How can the various participants in a company be encouraged to work toward a common goal? Marketing and manufacturing reward structures often tend to be in conflict yet the firm has overall profitability goals. Does the answer lie in similar reward structures, rewards tied to overall performance, or will process teams accomplish much of this? Beyond internal integration, how should inter-organizational change management be implemented?
2. How should the existing supply chain be mapped? Should the map include all connected firms or only the primary firms? Are there other means of determining who should and should not be part of the supply chain map? What are the implications for good SCM practice based upon the horizontal structure, the vertical structure, and focal company position in the supply chain?
3. What is the value proposition at the consumer level or end point of the supply chain? What are the methods

-
- that should be used to determine value? How should the various firms in the supply chain share the costs and the benefits?
4. What metrics should be used to evaluate the performance of the entire supply chain, individual members or subsets of members? What are the potential barriers to implementation and how should they be overcome?
 5. What is the process to take the map of the existing supply chain and to modify it to obtain the best supply chain given the desired outputs?
 6. What determines with whom to link business processes? What are the steps to take to determine with whom to link? What are the critical factors to the firm's success and that enable the firm to link with specific companies? What are the barriers to forming these relationships?
 7. What determines the processes to link with these key members? How should the firm decide which internal processes to link with suppliers and customers? What decision criteria determine whose internal business processes prevail across all or part of the supply chain?
 8. What determines the type/level of integration that should be applied to each process link? It is important to provide firms with some guidelines regarding what level of management components to apply to achieve the desired relationship and management of a link. Do changes in the physical and technical components automatically require changes in the managerial and behavioral components?

CONCLUSIONS

Executives are becoming aware of the emerging paradigm of internetwork competition and that the successful integration and management of key business processes across members of the supply chain will determine the ultimate success of the single enterprise. Managing the supply chain cannot be left to chance. For this reason, executives are striving to interpret and to determine how to manage the company's supply chain network, and thereby achieve the potential of SCM.

Our research indicated that managing the supply chain involves three closely interrelated elements: 1) the supply chain network structure; 2) the supply chain business processes; and 3) the management components. Our research further suggested that the structure of activities/processes within and between companies is vital for creating superior competitiveness and profitability, and that

successful SCM requires integrating business processes with key members of the supply chain. Much friction, and thus waste of valuable resources, results when supply chains are not integrated, appropriately streamlined, and managed. A prerequisite for successful SCM is to coordinate activities within the firm. One way to do this is to identify the key business processes and manage them using cross-functional teams. Hopefully, this paper provides clarification on key aspects of SCM that will aid practitioners and researchers in their desire to understand and implement SCM.

It is important to distinguish between primary and supporting supply chain members, and to identify the horizontal structure, vertical structure, and horizontal position of the focal company in the supply chain network. We have identified four fundamentally different types of business process links: 1) managed business process links; 2) monitored business process links; 3) not-managed business process links; and 4) non-member business process links.

Marketing researchers were in the forefront of studying critical aspects of what we now call SCM, particularly with respect to identifying the members of a channel of distribution. The focus was from the manufacturer to the customer for the most part. Our approach to SCM ensures inclusion of suppliers and customers, and there are several implications for marketing practitioners and researchers. There is a need to integrate activities across the firm and across firms in the supply chain. While marketing strategy formulation has always considered internal and external constraints, SCM makes the explicit evaluation of these factors even more critical. Additionally, traditional roles of marketing and sales people are changing. Team efforts are becoming more common for developing and marketing new products, as well as managing current ones. The role of the firm's sales force is changing to one of relationship management where measuring and selling the value proposition for the customer is criticized.

In combination, the SCM definition and this new framework moves the SCM philosophy to its next evolutionary stage. The implementation of SCM involves identifying the supply chain members with whom it is critical to link, what processes need to be linked, and what type/level of integration applies to each process link. The objective of SCM is to create the most value, not simply for the company, but for the whole supply chain network including the end customer. Consequently, supply chain process integration and reengineering should be designed

to increase process efficiency and effectiveness for the entire supply chain. It is critical that the benefits derived are equitably distributed.

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