

Supply Chain Management

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There is a great deal of confusion regarding exactly what supply chain management involves [1]. In fact, most people using the name supply chain management treat it as a synonym for logistics or as logistics that includes customers and suppliers. Others view supply chain management as the new name for purchasing or operations, or the combination of purchasing, operations and logistics. However, successful supply chain management requires cross-functional integration of key business processes within the firm and across the network of firms that comprise the supply chain. The challenge is to determine how to successfully accomplish this integration. First, supply chain management is defined. Next, sections describing what supply chain management is not and business process management are presented. Then, the framework for supply chain management is described followed by sections on the management components of supply chain management and mapping the supply chain. Finally, suggestions for implementation and conclusions are presented. Case studies conducted at several companies and involving multiple members of their supply chains are used to illustrate the concepts described.

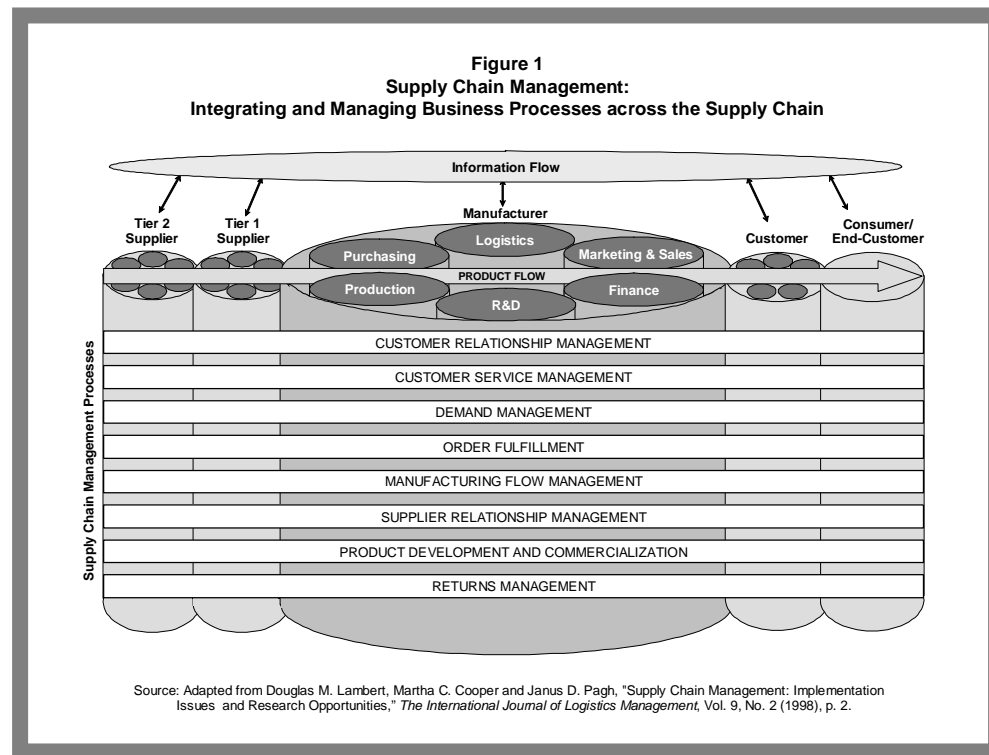
One of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather within supply chains. Business management has entered the era of inter-network competition. In this emerging competitive environment, the ultimate success of the single business will depend on management's ability to integrate the company's intricate network of business relationships [2].

Increasingly the management of 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 businesses and relationships. SCM offers the opportunity to capture the synergy of intra- and inter-company integration and management. In that sense, SCM deals with 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 has in general been following rather than leading business practice [3]. There is a need for building theory and developing normative tools and methods for successful SCM practice. The Global Supply Chain Forum, a group of non-competing firms and a team of academic researchers, has been meeting regularly since 1993 with the objective to improve the theory and practice of SCM. The definition of SCM developed and used by the members of The Global Supply Chain Forum follows [4]:

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 view of SCM is illustrated in Figure 1, which depicts a simplified supply chain network structure, the information and product flows, and the key supply chain management processes penetrating functional silos within the company as well as corporate silos across the supply chain. Thus, business processes become supply chain processes to manage the links across intra- and inter-company boundaries.



This paper is organized as follows. First there is a description of what SCM is not. This is followed by a brief literature review on business process management. Next, the conceptual framework of SCM is described. Then some of the findings and key issues related to each of the three elements of the SCM framework are reported. For simplicity each element is dealt with separately, although in practice they are closely interrelated. Issues regarding how to map business processes across the supply chain, and implement supply chain management are briefly described. Finally, conclusions are outlined.

What SCM Is Not

The term SCM was originally introduced by consultants in the early 1980's [5] and subsequently has become widely used [6]. Since the early 1990's, academics have attempted to give structure to SCM [7]. Bechtel and Jayaram [8] provided an extensive retrospective review of the literature and research on SCM. They identified generic schools of thought, and the major contributions and fundamental assumptions of SCM that must be challenged in the future.

Until recently most practitioners [9], consultants [10] and academics [11] viewed SCM as not appreciably different from the contemporary understanding of logistics management, as defined by the Council of Logistics Management (CLM) in 1986 [12]. 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 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 the CEO who said, "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. Everyone in the organization should focus on serving the customer's needs.

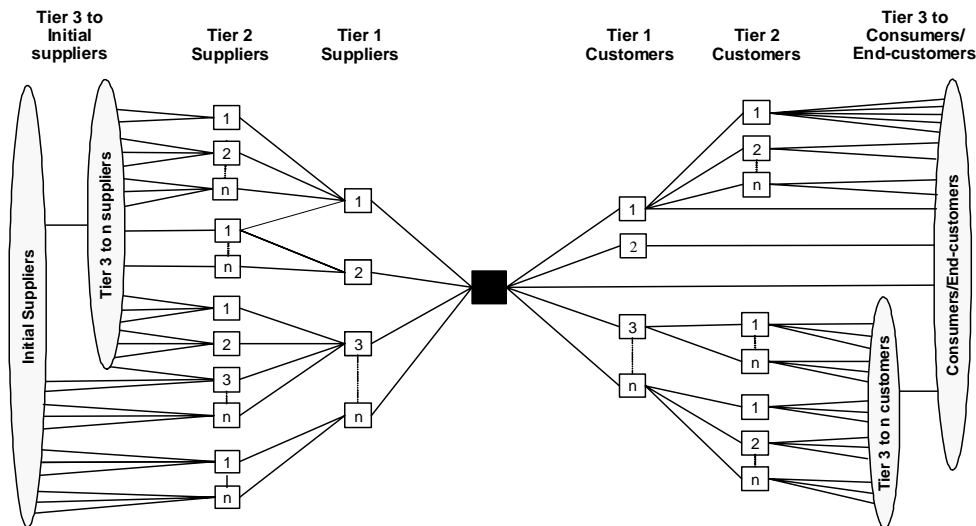
The understanding of SCM has been re-conceptualized from integrating logistics across the supply chain to integrating and managing key business processes across the supply chain [13]. Based on this emerging distinction between SCM and logistics, in 2003, CLM announced a modified definition of logistics. The modified definition explicitly declares CLM's position that logistics management is only a part of SCM. The revised definition follows:

Logistics is that part of the supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point-of-origin and the point-of-consumption in order to meet customers' requirements [14].

SCM is not just confused with logistics. Those in the operations management area, such as APICS, are renaming what they do as supply chain management [15] as are those working in the procurement area [16]. At Michigan State University and Arizona State University, departments of supply chain management have been created by combining purchasing, operations and logistics faculty, which is a perspective that has appeared in the literature [17]

Managing the entire supply chain is a very difficult and challenging task, as illustrated in Figure 2. Imagine the degree of complexity required managing all suppliers back to the point of origin and all products/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. In any case, managing all Tier 1 suppliers' networks to the point of origin is an enormous undertaking.

Figure 2
Supply Chain Network Structure



Source: Adapted from Douglas M. Lambert, Martha C. Cooper, and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2, 1998, p. 3.

Business Process Management

Increasingly, managers want to implement business processes and integrate them with other key members of the supply chain. A business process is a structured set of activities with specified business outcomes for customers [18]. Initially, business processes were viewed as a means to integrate corporate functions within the firm. Now, business processes are used to structure the activities between members of a supply chain. Hammer has pointed out that it is in the integration of business processes across firms in the supply chain where the real "gold" can be found [19].

The concept of organizing the activities of a firm as business processes was introduced in the late 1980s [20] and became popular in the early 1990s, after the publication of books by Hammer and Champy [21], and Davenport [22]. The motivation for implementing business processes within and across members of the supply chain might be to make transactions efficient and effective, or to structure inter-firm relationships in the supply chain. Both approaches to implementing business processes are customer oriented. The first focuses on meeting the customer's expectations for each transaction, the other on achieving longer term mutual fulfillment of promises.

The transactional view of business process management is rooted in advances in information and communication technology which enabled time compression and availability of information throughout the organization [23]. The focus is not on automating the established business processes, but on redesigning businesses [24]. This transactional approach to redesigning business processes is based on Taylor's principles of scientific management which

aim to increase organizational efficiency and effectiveness using engineering principles from manufacturing operations [25]. In this case, business process redesign is based on standardizing transactions and the transfer of information [26]. The goal is to improve outcomes for customers by making transactions more efficient and accurate.

The second view of business process management focuses on managing relationships in the supply chain and is based on an evolving view from the field of marketing. A significant amount of the marketing literature is concerned with market transactions (business transactions with customers) and the fulfillment of orders. Rooted in economic theory, researchers studied the efficiency of transactions with the customers, which raised awareness about the importance of customer retention [27]. Obtaining repeat business from the same customer, that is to conduct multiple transactions, is more cost efficient than obtaining a new customer [28]. This traditional view of marketing as managing transactions with customers is dominated by the “4Ps”: product, price, promotion, and place [29].

The early marketing channels researchers such as Alderson and Bucklin conceptualized why and how channels are created and structured [30]. From a supply chain standpoint these researchers were on the right track in terms 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 35 years most marketing 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. 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. 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. In 1992, Webster [31] challenged marketers and marketing researchers to consider relationships with multiple firms. He also called for cross-functional consideration in strategy formulation.

During the 1990s, a paradigm shift occurred with the introduction of the concept of *relationship marketing* [32]. The goal of relationship marketing “...is to establish, maintain, and enhance... relationships with customers and other partners, at a profit, so that the objectives of the parties involved are met. This is achieved by mutual exchange and fulfillment of promises”[33]. Thus, the focus of developing and maintaining relationships in the supply chain is beyond the fulfillment of one or a set of transactions. In the new environment, managers need to focus on helping customers achieve their objectives.

The field of relationship marketing is focused on the customer-side, looking downstream in the supply chain. However, the development and maintenance of relationships with key suppliers should be based on the same pillars, mutuality and fulfillment of promises, in order for suppliers to be profitable. Management needs the support of the firm’s key suppliers to fulfill the promises made to customers and meet financial goals. In other words, corporate success is based on relationship management with both suppliers and customers.

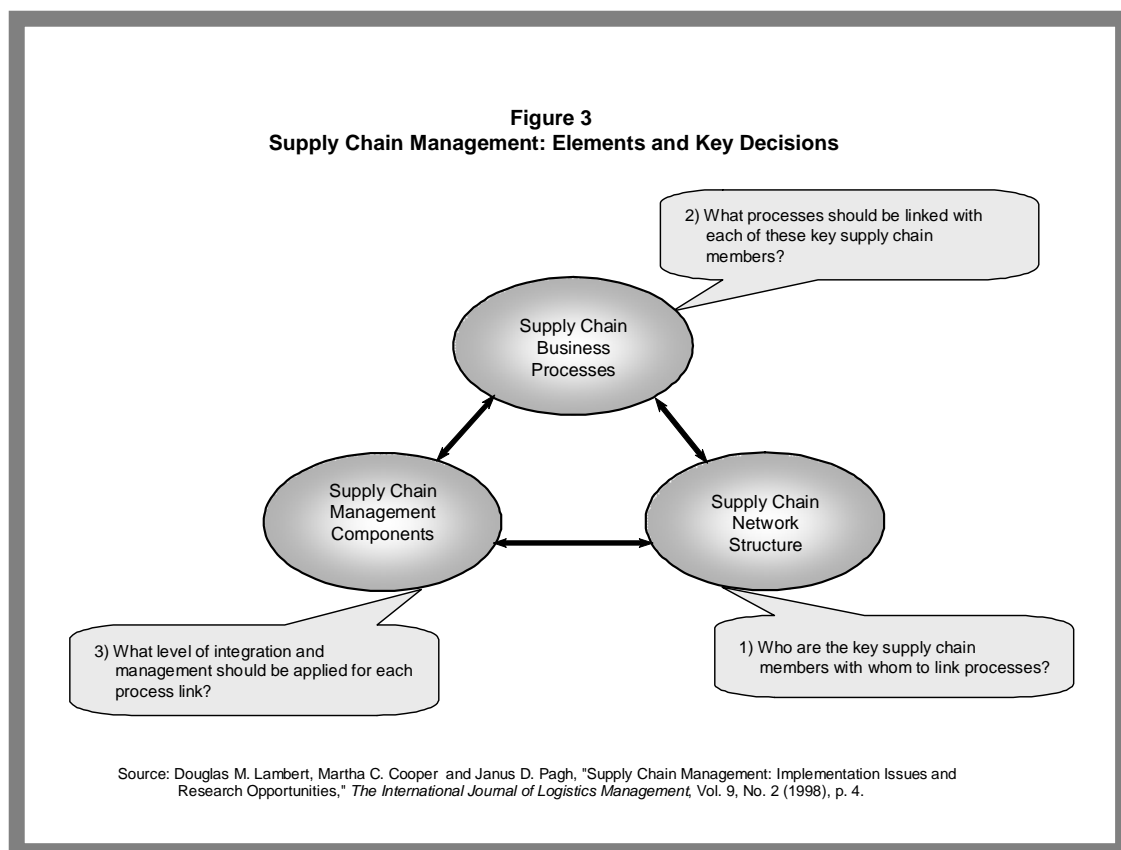
The management of inter-organizational relationships with members of the supply chain involves people, organizations, and processes [34]. In fact, the ability to manage inter-organizational relationships “... may define the core competence of some organizations as links

between their vendors and customers in the value chain” [35]. Several authors have suggested implementing business processes in the context of supply chain management, but there is not yet an “industry standard” on what these processes should be. The value of having standard business processes in place is that managers from organizations in the supply chain can use a common language and can link-up their firms’ processes with other members of the supply chain, as appropriate.

In 1994, executives from a group of international companies, later to become The Global Supply Chain Forum (GSCF), developed a definition of supply chain management. In February 1996 the GSCF framework was presented in a three-day executive seminar co-sponsored by the Council of Logistics Management, and was later presented in the literature [36]. The GSCF framework includes eight processes that are cross-functional and are meant to be implemented inter-organizationally across key members of the supply chain. The eight processes are: customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, product development and commercialization, supplier relationship management, and returns management. The motivation behind developing the framework was to provide structure to assist academics with their research on supply chain management and practitioners with implementation.

A Conceptual Framework of SCM

Figure 3 illustrates the inter-related 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 inter-related elements: the supply chain network structure, the supply chain business processes, and the supply chain management components.

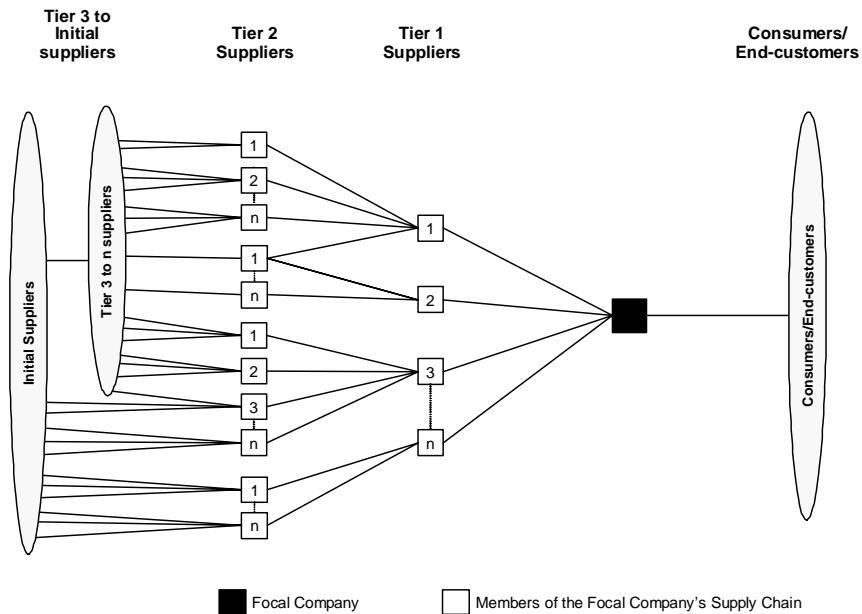


The supply chain network structure is comprised of the member firms and the links between these firms. Business processes are the activities that produce a specific output of value to the customer. The management components are the managerial methods by which the business processes are integrated and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

Supply Chain Network Structure

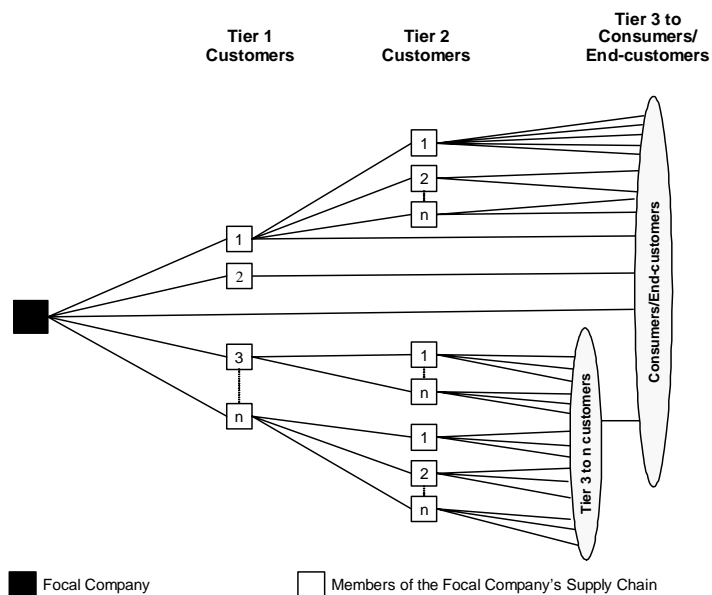
All firms participate in supply chains from the raw materials to the end consumer. How much of these supply chains need to be managed depends on several factors, such as the complexity of the product, the number of available suppliers, and the availability of raw materials. Dimensions to consider include the length of the supply chain and the number of suppliers and customers at each tier. It would be rare for a firm to participate in only one supply chain. The supply chain network will look different depending on a firm's position in the supply chain. For most manufacturers positioned in the middle of the supply chain such as 3M, Colgate-Palmolive and Hewlett-Packard, 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 (see Figure 2) [37]. The question is how many of these branches and roots need to be managed. It should be noted that in each firm, management views its organization as the focal company and the supply chain will look different depending on where the firm is positioned in it. For example, for a retailer such as Wal-Mart, the supply chain looks like a Bayesian decision tree (the root system of the uprooted tree). Figure 4 illustrates a supply chain network structure for a retailer. The supply chain network for a shrimper in the Gulf of Mexico is depicted in Figure 5.

Figure 4
Supply Chain Network Structure: Retailer's Perspective



Source: Adapted from Douglas M. Lambert, Martha C. Cooper, and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2, 1998, p. 3.

Figure 5
Supply Chain Network Structure: Shrimper's Perspective



Source: Adapted from Douglas M. Lambert, Martha C. Cooper, and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2, 1998, p. 3.

Management needs to choose the type of relationship appropriate for particular supply chain links [38]. 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 [39]. 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. The three primary structural 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.

Identifying Supply Chain Members. When determining the network structure, it is necessary to identify those firms that are the members of the supply chain. Including all types of members may cause the network to become highly complex, since it may explode in the number of members added from tier to tier [40]. To integrate and manage all process links with all members across the supply chain would, in most cases, be counter-productive, 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 takes part in the various marketing flows, including product, title, payment, information, and promotion flows [41]. Each flow included relevant members, such as banks for the payment flow and advertising agencies for the promotion flow. The channels researchers sought to include all members taking part in the 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 interviews and discussions with the members of The Global Supply Chain Forum, and by applying the definition of a business process by Davenport [42]. Primary members of a supply chain are 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 primary members.

The same company can perform both primary and supporting activities. Likewise, the same company can perform primary activities related to one process and supporting activities related to another process. An example from one of the case studies is an OEM that buys some

critical and complex production equipment from a supplier. When the OEM develops new products they work very closely with the equipment supplier to assure there is the right equipment to make the new product. Thus the supplier is a primary member of the OEM's product development and commercialization process. However, once the machinery is in place, the supplier is a supporting and not a primary member for the manufacturing flow management process, since supplying the equipment does not in itself add value to the output of the process even though the equipment adds value.

It should be noted that the distinction between primary and supporting supply chain members is not obvious in all cases. Nevertheless, 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 distinguished between primary and support activities in his "value chain" framework [43].

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 *horizontal structure* refers to the number of tiers across the supply chain (see Figure 2). 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 *vertical structure* refers to the number of suppliers/customers represented within each tier (see Figure 2). A company can have a narrow vertical structure, with few companies at each tier, or a wide vertical structure with many suppliers and/or customers at each tier. 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 effects 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 another example of decision making that may 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 strain resources in terms of how many process links the focal company can integrate and closely manage beyond Tier 1. In

general, our research team has found that companies with immediately wide vertical structures, actively managed only a few Tier 2 customers or suppliers. Some of the companies studied have transferred servicing small customers to distributors, thus, moving the small customers further down the supply chain from the focal company. This principle, known as functional spin-off, is described in the marketing channels literature [44], and also can be applied to the focal company's network of suppliers.

In the companies studied, the supply chains 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 integration and management of business processes across company boundaries will be successful only if it makes sense from each company's perspective [45].

Supply Chain Management Processes

Successful supply chain management requires a change from managing individual functions to integrating activities into key supply chain management processes. 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 Global Supply Chain Forum are:

- customer relationship management
- customer service management
- demand management
- order fulfillment
- manufacturing flow management
- supplier relationship management
- product development and commercialization
- returns management

These processes are shown in Figure 1. A description of each of the eight processes follows [46].

Customer Relationship Management. Customer relationship management provides the structure for how the relationships with customers will be developed and maintained. Management identifies key customers and customer groups to be targeted as part of the firm's business mission. The goal is to segment customers based on their value over time and increase customer loyalty by providing customized products and services. Cross-functional customer teams tailor Product and Service Agreements (PSA) to meet the needs of key accounts and for segments of other customers. The PSAs specify levels of performance. The teams work with key customers to improve processes and eliminate demand variability and non-value-added activities. Performance reports are designed to measure the profitability of individual customers as well as the financial impact on the customer [47].

Customer Service Management. Customer service management is the firm's face to the customer. It provides the key point of contact for administering the PSA. Customer service provides the customer with real-time information on promised shipping dates and product availability through interfaces with the firm's functions such as manufacturing and logistics.

The customer service process may also include assisting the customer with product applications.

Demand Management. Demand management is the supply chain management process that balances the customers' requirements with the capabilities of the supply chain. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions. The process is not limited to forecasting. It includes synchronizing supply and demand, increasing flexibility, and reducing variability. 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 advanced applications customer demand and production rates are synchronized to manage inventories globally.

Order Fulfillment. The order fulfillment process involves more than just filling orders. It includes all activities necessary to define customer requirement and to design a network and a process that permits a firm to meet customer requests while minimizing the total delivered cost as well as filling customer orders. This is not just the logistics function, but instead needs to be implemented cross-functionally and with the coordination of key suppliers and customers. 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. Manufacturing flow management is the supply chain management process that includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain. Manufacturing flexibility reflects the ability to make a wide variety of products in a timely manner at the lowest possible cost. To achieve the desired level of manufacturing flexibility, planning and execution must extend beyond the four walls of the manufacturer in the supply chain.

Supplier Relationship Management. Supplier relationship management is the process that defines how a company interacts with its suppliers. As the name suggests, this is a mirror image of customer relationship management. Just as a company needs to develop relationships with its customers, it also needs to foster relationships with its suppliers. As in the case of customer relationship management, a company will forge close relationships with a small subset of its suppliers, and manage arm-length relationships with others. A PSA is negotiated with each key supplier that defines the terms of the relationship. For segments of less critical suppliers, the PSA is not negotiable. Supplier relationship management is about defining and managing these PSAs. Long-term relationships are developed with a small core group of suppliers. The desired outcome is a win-win relationship where both parties benefit.

Product Development and Commercialization. Product development and commercialization is the supply chain management process that provides the structure for developing and bringing to market products jointly with customers and suppliers. The product development and commercialization process team must coordinate with customer relationship management to identify customer articulated and unarticulated needs; select materials and

suppliers in conjunction with the supplier relationship management process; and, develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

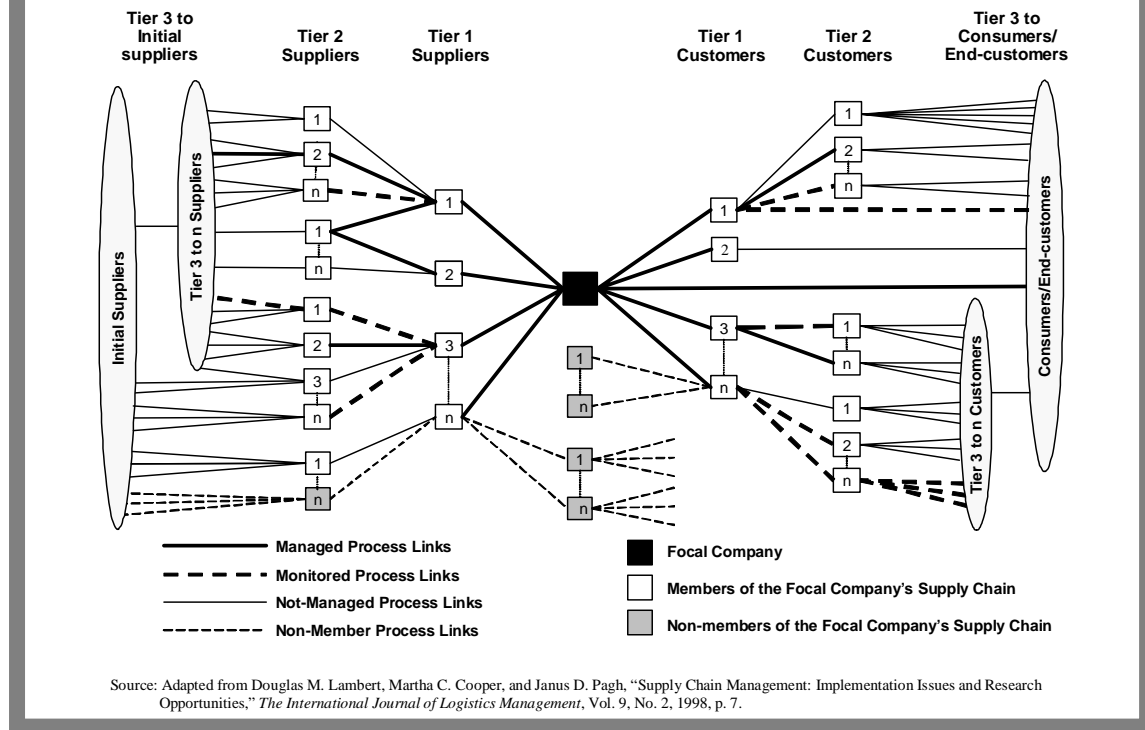
Returns Management. Returns management is the supply chain management process by which activities associated with returns, reverse logistics, gatekeeping, and avoidance are managed within the firm and across key members of the supply chain. The correct implementation of this process enables management not only to manage the reverse product flow efficiently, but to identify opportunities to reduce unwanted returns and to control reusable assets such as containers. Effective returns management is an important part of SCM and provides an opportunity to achieve a sustainable competitive advantage.

Types of Business Process Links

As previously noted, 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 [48]. As a consequence, the task of allocating scarce resources among the different business process links across the supply chain becomes crucial. The Global Supply Chain Forum 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 non-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 6, 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 6, the focal company is actively involved in the management of a number of other process links beyond Tier 1.

Figure 6
Types of Inter-company Business Process Links



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 6 indicate the monitored process links.

Not-managed Process Links. Not-managed process links are links that the focal company is not actively involved in managing, 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 6 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 carton 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 carton supplier.

Non-member Process Links. The case studies 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 6 illustrate examples of non-member process links.

Based on the described process links, our research reveals variation in how closely companies integrate and manage links further away from the first tier. In some companies, management works 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 negotiates contracts with suppliers of equipment and agricultural chemicals such as fertilizer and pesticides. The farmers are encouraged to purchase materials and machinery using the manufacturer's 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 who, 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 semi-conductors. 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.

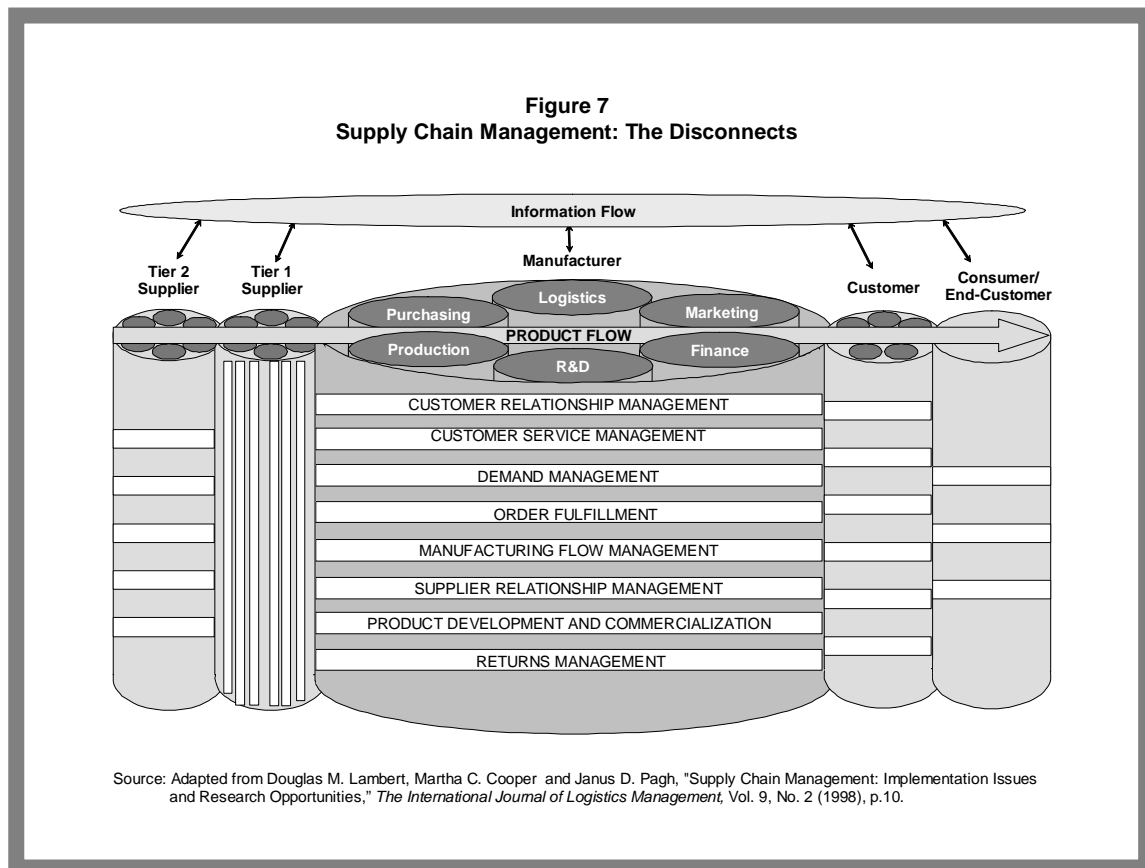
The Requirement for Standard Business Processes

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 [49]. When two companies build a relationship, certain of their internal activities will be linked and managed between the two companies [50]. 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 effect 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 stress that "the structure of activities within and between companies is a critical cornerstone of creating unique and superior supply chain performance" [51]. In this research, 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" [52].

Our research team has found that in some companies executives emphasize 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. This lack of inter-company consistency is a cause for significant friction and inefficiencies in supply chains. It is important that managers in different

firms speak the same language (use the same terminology). At least with functional silos, there is generally an understanding of what corporate 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 7.



It is necessary to address which processes are critical and/or beneficial to integrate and manage across the supply chain. In the case study companies, it became clear that in some cases business processes extended to suppliers and were managed to some extent between the two firms involved. This may imply that when a leadership role is taken, firms in the supply chain will use the same 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 should be integrated and managed between companies will likely vary. However, in each specific case, it is important that executives thoroughly analyze and discuss which 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 Supply Chain Management

The management components of SCM 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 [53]. Consequently, adding more management components or increasing the level of each component can increase the level of integration of the business process link.

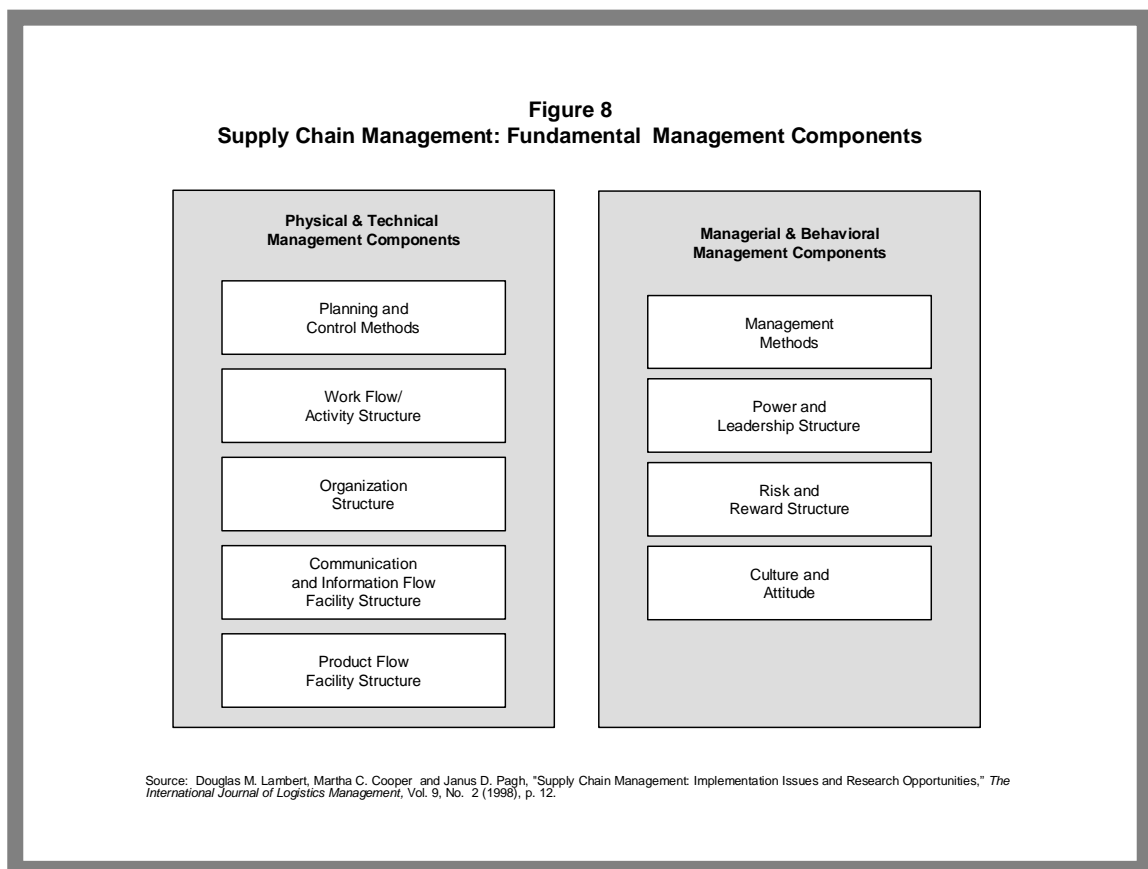
The literature on business process reengineering [54], buyer-supplier relationships [55], and SCM [56] suggests numerous possible components that must receive managerial attention when managing supply chain relationships. Based on the management components identified in our previous work, review of the literature, and interviews with 80 managers, nine management components are identified for successful SCM: planning and control, work structure, organization structure, product flow facility structure, information flow facility structure, management 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 but planning transcends the phases [57]. 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 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 distribution 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 semi-finished 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 leader will drive the direction of the chain. In most supply chains studied to date, there are one or two strong leaders among the firms. The exercise of power, or lack of, can affect the level of commitment of other members. Forced participation will encourage exit behavior, given the opportunity [58]. The anticipation of sharing

of risks and rewards across the supply chain affects long-term commitment of its members.

- The importance of corporate culture and its compatibility across members of the supply chain cannot be underestimated. Meshing cultures and individuals' attitudes is time consuming but is necessary at some level for the channel to perform as a chain. Aspects of culture include how employees are valued and incorporated into the management of the firm.

Figure 8 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. This research, and much literature on change management [59] shows that if this group of management components is the only focus of managerial attention, the results will be disappointing at best.



The second group is comprised of the managerial and behavioral components. These components are less tangible 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, the supply chain will likely be less competitive and profitable. If one or more components in the physical and technical group are changed, 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

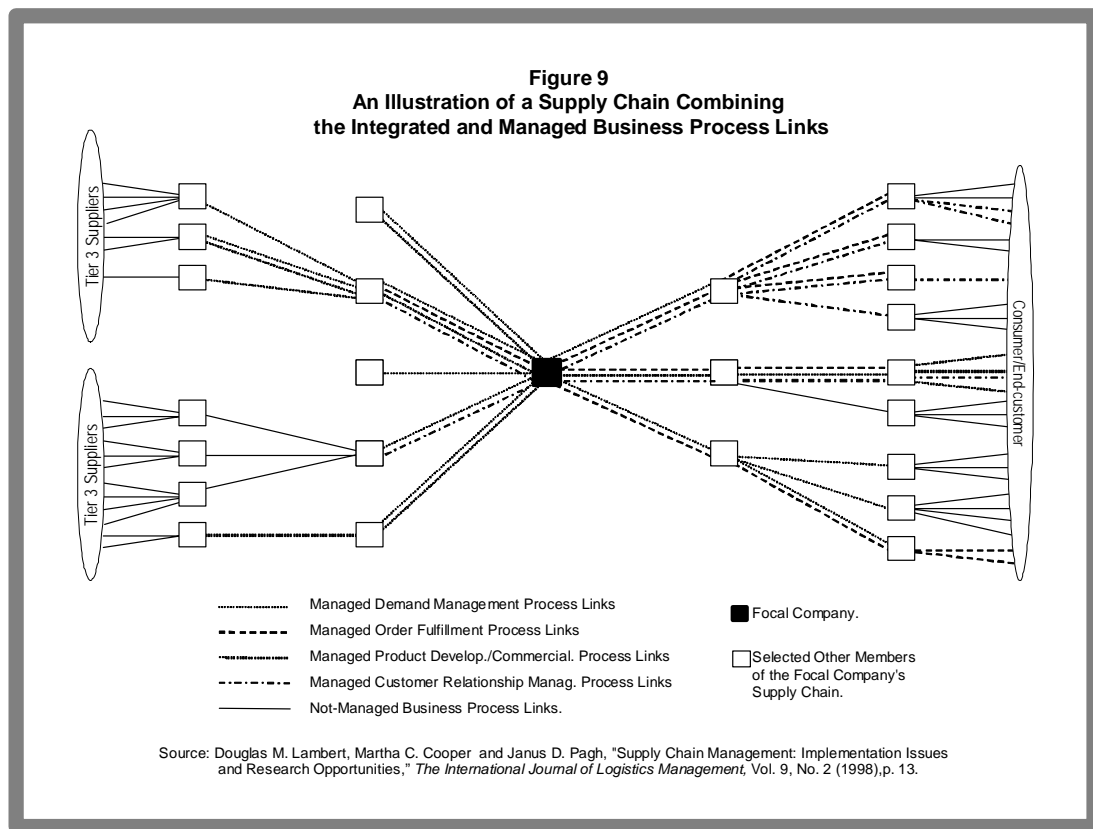
these SCM components and their interdependence. Hewitt stated that true intra- and inter-company business process management, or redesign, is only likely to be successful if it is recognized as a multi-component change process, simultaneously and explicitly addressing all SCM components [60].

All nine management components were found in the business process links studied, including examples of successful SCM applications. However, the number, levels of components and combinations of representations varied. A finding is that 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. Only one example was found of managerial and behavioral management components applied more than one link across the supply chain.

Mapping the Supply Chain

In the companies studied, management did not link all eight business processes across all firms in the same tier. 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 and commercialization process, whereas the demand management process is linked with both suppliers. Management will choose to integrate and manage different supply chain links with the business processes that offer both firms the potential for improved performance.

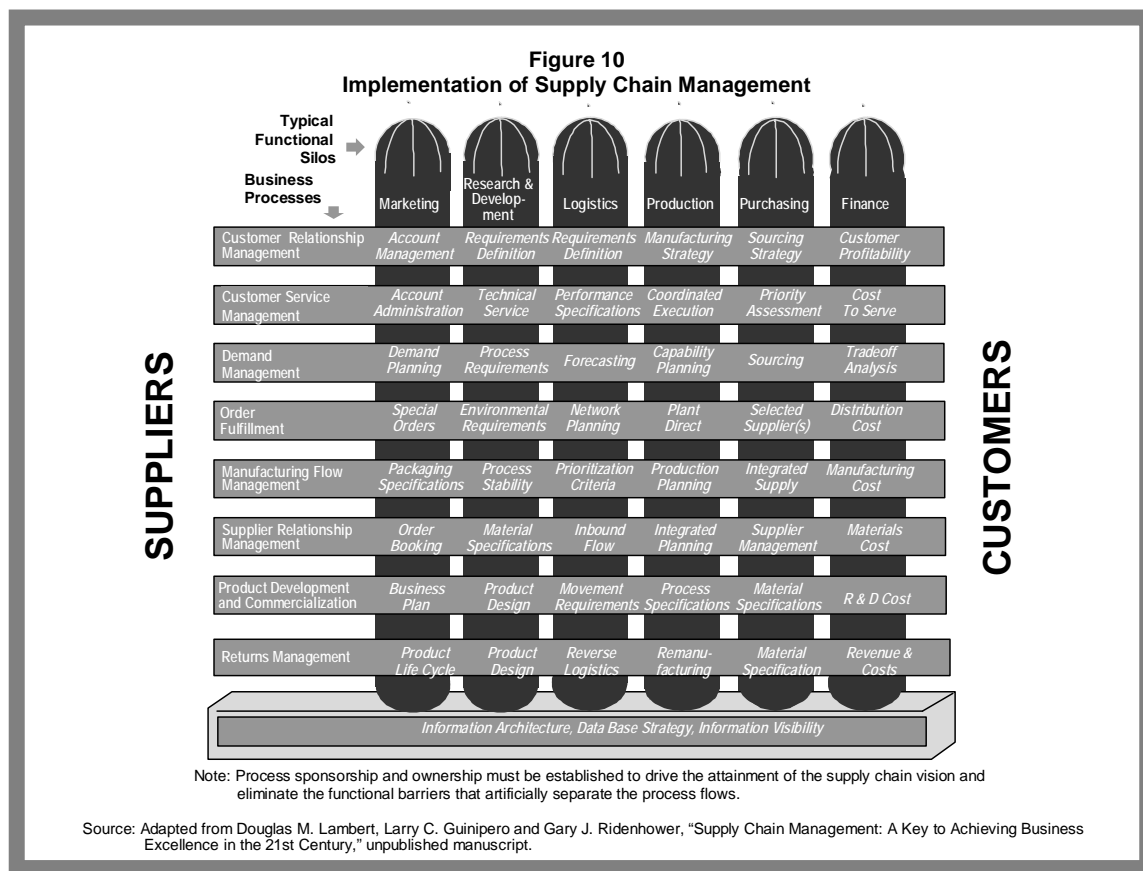
Figure 9 is an illustration of how the integrated and managed business process links of a focal company may differ from process to process. For simplicity only the managed and not-managed business process links are illustrated. The monitored and non-member process links are omitted. Only very few supply chain members are included. Also, the diagram only contains four of the business processes. It is suggested that managers map individual processes and then superimpose them on one supply chain map.



Previous literature has indicated 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 this research, there were no examples of this, nor were there any in the cases described in the literature. In fact the companies studied had only integrated some selected key process links, and were likewise only monitoring some other selected links.

Implementing Supply Chain Management

Implementing SCM requires making the transition from a focus on functions to a focus on supply chain management processes. Figure 10 illustrates how each function within the organization provides input to the eight key processes.



In the customer relationship management process, sales and marketing provides the account management expertise, engineering provides the specifications which define the requirements, logistics provides knowledge of customer service requirements, manufacturing provides the manufacturing strategy, purchasing provides the sourcing strategy, and finance provides customer profitability reports. The customer service requirements must be used as input to manufacturing, sourcing, and logistics strategies.

If the proper coordination mechanisms are not in place across the various functions, the process will be neither effective or efficient. By taking a process focus all functions that touch the product or provide information must work together. For example, purchasing depends on sales/marketing data fed through a production schedule to assess specific order levels and timing of requirements. These orders drive production requirements which in turn are transmitted upstream to suppliers.

The use of outsourcing has accelerated the need to coordinate supply chain processes since the organization becomes more dependent on outside contractor suppliers. Consequently, coordination mechanisms must be in place within the organization. When logistics third parties are used they serve on process teams as representatives of the logistics function.

There are several process redesign and reengineering techniques that can be applied to the supply chain management processes. Chrysler Corporation's development of Neon was accomplished through the efforts of 150 internal employees. This core group leveraged their efforts to 600 engineers, 289 suppliers and line employees. Concurrent engineering techniques required the involvement of personnel from all key functional areas working with suppliers to

develop the vehicle in 42 months. The use of concurrent engineering resulted in the avoidance of later disagreements, misunderstandings and delays.

Typically, firms within the supply chain will have their own functional silos that must be overcome and a process approach accepted in order to successfully implement SCM. The requirements for successful implementation of SCM include:

- Executive support, leadership and commitment to change.
- An understanding of the degree of change that is necessary.
- Agreement on the SCM vision and the key processes.
- The necessary commitment of resources and empowerment to achieve the stated goals.

Conclusions

Executives are becoming aware of the emerging paradigm of inter-network competition, and that the successful integration and management of key supply chain management 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 determine how to manage the company's supply chain network, and achieve the potential of SCM.

Research with member firms of The Global Supply Chain Forum at The Ohio State University indicates that managing the supply chain involves three closely inter-related elements: 1) the supply chain network structure; 2) the supply chain business processes; and, 3) the management components. The structure of activities/processes within and between companies is vital for creating superior competitiveness and profitability. 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.

It is important to distinguish between primary and supporting supply chain members, and to identify the horizontal structure, the vertical structure, and the horizontal position of the focal company in the supply chain network. There are four fundamentally different types of business process links: managed business process links, monitored business process links, not managed business process links, and non-member business process links.

Marketing researchers were in the forefront of studying critical aspects of what we now call supply chain management, 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. The approach to SCM presented here ensures inclusion of suppliers and customers. 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 measuring and selling the value that the firm is providing for the customer.

In combination, the SCM definition and the new framework move 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 with each of these key members, 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 the whole supply chain network including the end-customer. Consequently, supply chain process integration and reengineering initiatives should be aimed at boosting total process efficiency and effectiveness across members of the supply chain.

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