Supply Chain Management

Supply chain management (SCM) is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers (Harland, 1996). Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.

The definition an American professional association put forward is that Supply Chain Management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperates to provide product and service offerings has been called the Extended Enterprise.

Supply Chain Management can also refer to Supply chain management software which are tools or modules used in executing supply chain transactions, managing supplier relationships and controlling associated business processes.

Supply chain event management (abbreviated as SCEM) is a consideration of all possible occurring events and factors that can cause a disruption in a supply chain. With SCEM possible scenarios can be created and solutions can be planned.

Supply Chain Management Problems

Supply chain management must address the following problems:

* Distribution Network Configuration: Number, location and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks and customers.

* Distribution Strategy: Including questions of operating control (centralized, decentralized or shared); delivery scheme (e.g., direct shipment, pool point shipping, Cross docking, DSD (direct store delivery), closed loop shipping); mode of transportation (e.g., motor carrier, including truckload, LTL, parcel; railroad; intermodal, including TOFC and COFC; ocean freight; airfreight); replenishment strategy (e.g., pull, push or hybrid); and transportation control (e.g., owner-operated, private carrier, common carrier, contract carrier, or 3PL). Trade-Offs in Logistical Activities

The above activities must be coordinated well together in order to achieve the least total logistics cost. Trade-offs exist that increase the total cost if only one of the activities is optimized. For

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example, full truckload (FTL) rates are more economical on a cost per pallet basis than less than truckload (LTL) shipments. If, however, a full truckload of a product is ordered to reduce transportation costs there will be an increase in inventory holding costs which may increase total logistics costs. It is therefore imperative to take a systems approach when planning logistical activities. These trade-offs are key to developing the most efficient and effective Logistics and SCM strategy.

* Information: Integration of and other processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, and potential collaboration etc.
* Inventory Management: Quantity and location of inventory including raw materials, work-in-progress (WIP) and finished goods.
* Cash-Flow: Arranging the payment terms and the methodologies for exchanging funds across entities within the supply chain.

Supply chain execution is managing and coordinating the movement of materials, information and funds across the supply chain. The flow is bi-directional.

Activities/functions

Supply chain management is a cross-function approach to manage the movement of raw materials into an organization, certain aspects of the internal processing of materials into finished goods, and then the movement of finished goods out of the organization toward the end-consumer. As organizations strive to focus on core competencies and becoming more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other entities that can perform the activities better or more cost effectively. The effect is to increase the number of organizations involved in satisfying customer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts. The purpose of supply chain management is to improve trust and collaboration among supply chain partners, thus improving inventory visibility and improving inventory velocity.

Several models have been proposed for understanding the activities required to manage material movements across organizational and functional boundaries. SCOR is a supply chain management model promoted by the Supply Chain Council. Another model is the SCM Model proposed by the Global Supply Chain Forum (GSCF). Supply chain activities can be grouped into strategic, tactical, and operational levels of activities.

**Strategic**

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* Strategic network optimization, including the number, location, and size of warehousing, distribution centers, and facilities

* Strategic partnership with suppliers, distributors, and customers, creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics

* Product life cycle management, so that new and existing products can be optimally integrated into the supply chain and capacity management

* Information Technology infrastructure, to support supply chain operations

* Where-to-make and what-to-make-or-buy decisions

* Aligning overall organizational strategy with supply strategy

Tactical

* Sourcing contracts and other purchasing decisions.

* Production decisions, including contracting, scheduling, and planning process definition.

* Inventory decisions, including quantity, location, and quality of inventory.

* Transportation strategy, including frequency, routes, and contracting.

* Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.

* Milestone payments

* Focus on customer demand.

Operational

* Daily production and distribution planning, including all nodes in the supply chain.

* Production scheduling for each manufacturing facility in the supply chain (minute by minute).

* Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers.

* Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.

* Inbound operations, including transportation from suppliers and receiving inventory.

* Production operations, including the consumption of materials and flow of finished goods.

* Outbound operations, including all fulfillment activities, warehousing and transportation to customers.

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* Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.

Supply chain management

Organizations increasingly find that they must rely on effective supply chains, or networks, to successfully compete in the global market and networked economy. In Peter Drucker's (1998) new management paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

During the past decades, globalization, outsourcing and information technology have enabled many organizations, such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities (Scott, 1993). This inter-organizational supply network can be acknowledged as a new form of organization. However, with the complicated interactions among the players, the network structure fits neither "market" nor "hierarchy" categories (Powell, 1990). It is not clear what kind of performance impacts different supply network structures could have on firms, and little is known about the coordination conditions and trade-offs that may exist among the players. From a systems perspective, a complex network structure can be decomposed into individual component firms (Zhang and Dilts, 2004). Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players. Therefore, the choice of an internal management control structure is known to impact local firm performance (Mintzberg, 1979).

In the 21st century, changes in the business environment have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of multinational companies, joint ventures, strategic alliances and business partnerships, there were found to be significant success factors, following the earlier "Just-In-Time", "Lean Manufacturing" and "Agile Manufacturing" practices. Second, technological changes, particularly the dramatic fall in information communication costs, which are a significant component of transaction costs, have led to changes in coordination among the members of the supply chain network (Coase, 1998).

Many researchers have recognized these kinds of supply network structures as a new organization form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", "Global Production Network", and "Next Generation Manufacturing System". In general, such a structure can be defined as "a group of semi-independent organizations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration" (Akkermans, 2001).

The security management system for supply chain is described in ISO/IEC 28000 and ISO/IEC 28001 and related standards published jointly by ISO and IEC.

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Developments in Supply Chain Management

Six major movements can be observed in the evolution of supply chain management studies: Creation, Integration, and Globalization (Lavassani et al., 2008a), Specialization Phases One and Two, and SCM 2.0.

1. Creation Era

The term supply chain management was first coined by an American industry consultant in the early 1980s. However the concept of supply chain in management, was of great importance long before in the early 20th century, especially by the creation of the assembly line. The characteristics of this era of supply chain management include the need for large scale changes, re-engineering, downsizing driven by cost reduction programs, and widespread attention to the Japanese practice of management.

2. Integration Era

This era of supply chain management studies was highlighted with the development of Electronic Data Interchange (EDI) systems in the 1960s and developed through the 1990s by the introduction of Enterprise Resource Planning (ERP) systems. This era has continued to develop into the 21st century with the expansion of internet-based collaborative systems. This era of SC evolution is characterized by both increasing value-added and cost reduction through integration.

3. Globalization Era

The third movement of supply chain management development, globalization era, can be characterized by the attention towards global systems of supplier relations and the expansion of supply chain over national boundaries and into other continents. Although the use of global sources in the supply chain of organizations can be traced back to several decades ago (e.g. the oil industry), it was not until the late 1980s that a considerable number of organizations started to integrate global sources into their core business. This era is characterized by the globalization of supply chain management in organizations with the goal of increasing competitive advantage, creating more value-added, and reducing costs through global sourcing.

4. Specialization Era—Phase One—Outsourced Manufacturing and Distribution

In the 1990s industries began to focus on core competencies and adopted a specialization model. Companies abandoned vertical integration, sold off non-core operations, and outsourced those functions to other companies. This changed management requirements by extending the supply chain.
well beyond the four walls and distributing management across specialized supply chain partnerships.

This transition also re-focused the fundamental perspectives of each respective organization. OEMs became brand owners that needed deep visibility into their supply base. They had to control the entire supply chain from above instead of from within. Contract manufacturers had to manage bills of material with different part numbering schemes from multiple OEMs and support customer requests for work-in-process visibility and vendor-managed inventory (VMI).

The specialization model creates manufacturing and distribution networks composed of multiple, individual supply chains specific to products, suppliers, and customers who work together to design, manufacture, distribute, market, sell, and service a product. The set of partners may change according to a given market, region, or channel, resulting in a proliferation of trading partner environments, each with its own unique characteristics and demands.

5. Specialization Era—Phase Two—Supply Chain Management as a Service

Specialization within the supply chain began in the 1980s with the inception of transportation brokerages, warehouse management, and non asset based carriers and has matured beyond transportation and logistics into aspects of supply planning, collaboration, execution and performance management.

At any given moment, market forces could demand changes within suppliers, logistics providers, locations, customers and any number of these specialized participants within supply chain networks. This variability has significant effect on the supply chain infrastructure, from the foundation layers of establishing and managing the electronic communication between the trading partners to the more complex requirements, including the configuration of the processes and work flows that are essential to the management of the network itself.

Supply chain specialization enables companies to improve their overall competencies in the same way that outsourced manufacturing and distribution has done; it allows them to focus on their core competencies and assemble networks of best in class domain specific partners to contribute to the overall value chain itself – thus increasing overall performance and efficiency. The ability to quickly obtain and deploy this domain specific supply chain expertise without developing and maintaining an entirely unique and complex competency in house is the leading reason why supply chain specialization is gaining popularity.

Outsourced technology hosting for supply chain solutions debuted in the late 1990s and has taken root in transportation and collaboration categories most dominantly. This has progressed from the Application Service Provider (ASP) model from approximately 1998 through 2003 to the On-Demand model from approximately 2003-2006 to the Software as a Service (SaaS) model we are currently focused on today.

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6. Supply Chain Management 2.0 (SCM 2.0)

Building off of globalization and specialization, SCM 2.0 has been coined to describe both the changes within the supply chain itself as well as the evolution of the processes, methods and tools that manage it in this new "era".

Web 2.0 is defined as a trend in the use of the World Wide Web that is meant to increase creativity, information sharing, and collaboration among users. At its core, the common attribute that Web 2.0 brings is it helps us navigate the vast amount of information available on the web to find what we are looking for. It is the notion of a usable pathway. SCM 2.0 follows this notion into supply chain operations. It is the pathway to SCM results – the combination of the processes, methodologies, tools and delivery options to guide companies to their results quickly as the complexity and speed of the supply chain increase due to the effects of global competition, rapid price fluctuations, surging oil prices, short product life cycles, expanded specialization, near/far and off shoring, and talent scarcity.

SCM 2.0 leverages proven solutions designed to rapidly deliver results with the agility to quickly manage future change for continuous flexibility, value and success. This is delivered through competency networks composed of best of breed supply chain domain expertise to understand which elements, both operationally and organizationally, are the critical few that deliver the results as well as the intimate understanding of how to manage these elements to achieve desired results, finally the solutions are delivered in a variety of options as no-touch via business process outsourcing, mid-touch via managed services and software as a service (SaaS), or high touch in the traditional software deployment model.

Supply chain business process integration

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. An example scenario: the purchasing department places orders as requirements become appropriate. Marketing, responding to customer demand, communicates with several distributors and retailers as it attempts to satisfy this demand. Shared information between supply chain partners can only be fully leveraged through process integration.

Supply chain business process integration involves collaborative work between buyers and suppliers, joint product development, common systems and shared information. According to Lambert and Cooper (2000) operating an integrated supply chain requires continuous information flow. However, in many companies, 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 stated by Lambert (2004) are:

* Customer relationship management

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* Customer service management
* Demand management
* Order fulfillment
* Manufacturing flow management
* Supplier relationship management
* Product development and commercialization
* Returns management

Much has been written about demand management. Best in Class companies have similar characteristics. They include the following: a) Internal and external collaboration b) Lead time reduction initiatives c) Tighter feedback from customer and market demand d) Customer level forecasting

One could suggest other key critical supply business processes combining these processes stated by Lambert such as:

1. Customer service management
2. Procurement
3. Product development and commercialization
4. Manufacturing flow management/support
5. Physical distribution
6. Outsourcing/partnerships
7. Performance measurement

a) Customer service management process

Customer Relationship Management concerns the relationship between the organization and its customers. Customer service provides the source of customer information. It also provides the customer with real-time information on promising dates and product availability through interfaces with the company’s production and distribution operations. Successful organizations use following steps to build customer relationships:

* determine mutually satisfying goals between organization and customers
* establish and maintain customer rapport

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* produce positive feelings in the organization and the customers

b) Procurement process

Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products. In firms where operations extend globally, sourcing should be managed on a global basis. The desired outcome is a win-win relationship, where both parties benefit, and reduction times in the design cycle and product development are achieved. Also, the purchasing function develops rapid communication systems, such as electronic data interchange (EDI) and Internet linkages to transfer possible requirements more rapidly. Activities related to obtaining products and materials from outside suppliers requires performing resource planning, supply sourcing, negotiation, order placement, inbound transportation, storage, handling and quality assurance, many of which include the responsibility to coordinate with suppliers in scheduling, supply continuity, hedging, and research into new sources or programs.

c) Product development and commercialization

Here, customers and suppliers must be united into the product development process, thus to reduce time to market. As product life cycles shorten, the appropriate products must be developed and successfully launched in ever shorter time-schedules to remain competitive. According to Lambert and Cooper (2000), managers of the product development and commercialization process must:

1. coordinate with customer relationship management to identify customer-articulated needs;
2. select materials and suppliers in conjunction with procurement, and
3. develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

d) Manufacturing flow management process

The manufacturing process is produced and supplies products to the distribution channels based on past forecasts. Manufacturing processes must be flexible to respond to market changes, and must accommodate mass customization. Orders are processes operating on a just-in-time (JIT) basis in minimum lot sizes. Also, changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness and efficiency of demand to customers. Activities related to planning, scheduling and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components, inventory at manufacturing sites and maximum flexibility in the coordination of geographic and final assemblies postponement of physical distribution operations.
e) Physical distribution

This concerns movement of a finished product/service to customers. In physical distribution, the customer is the final destination of a marketing channel, and the availability of the product/service is a vital part of each channel participant's marketing effort. It is also through the physical distribution process that the time and space of customer service become an integral part of marketing, thus it links a marketing channel with its customers (e.g. links manufacturers, wholesalers, retailers).

f) Outsourcing/partnerships

This is not just outsourcing the procurement of materials and components, but also outsourcing of services that traditionally have been provided in-house. The logic of this trend is that the company will increasingly focus on those activities in the value chain where it has a distinctive advantage and everything else it will outsource. This movement has been particularly evident in logistics where the provision of transport, warehousing and inventory control is increasingly subcontracted to specialists or logistics partners. Also, to manage and control this network of partners and suppliers requires a blend of both central and local involvement. Hence, strategic decisions need to be taken centrally with the monitoring and control of supplier performance and day-to-day liaison with logistics partners being best managed at a local level.

g) Performance measurement

Experts found a strong relationship from the largest arcs of supplier and customer integration to market share and profitability. By taking advantage of supplier capabilities and emphasizing a long-term supply chain perspective in customer relationships can be both correlated with firm performance. As logistics competency becomes a more critical factor in creating and maintaining competitive advantage, logistics measurement becomes increasingly important because the difference between profitable and unprofitable operations becomes more narrow. A.T. Kearney Consultants (1985) noted that firms engaging in comprehensive performance measurement realized improvements in overall productivity. According to experts internal measures are generally collected and analyzed by the firm including

1. Cost
2. Customer Service
3. Productivity measures
4. Asset measurement, and
5. Quality.

External performance measurement is examined through customer perception measures and "best
practice" benchmarking, and includes 1) customer perception measurement, and 2) best practice benchmarking. Components of Supply Chain Management are 1. Standardization 2. Postponement 3. Customization

Theories of Supply Chain Management

Currently there exists a gap in the literature available in the area of supply chain management studies, on providing theoretical support for explaining the existence and the boundaries of supply chain management. Few authors such as Halldorsson, et al. (2003), Ketchen and Hult (2006) and Lavassani, et al. (2008b) had tried to provide theoretical foundations for different areas related to supply chain with employing organizational theories. These theories includes:

* Resource-based view (RBV)
* Transaction Cost Analysis (TCA)
* Knowledge-based view (KBV)
* Strategic Choice Theory (SCT)
* Agency theory (AT)
* Institutional theory (InT)
* Systems Theory (ST)
* Network Perspective (NP)

Supply chain sustainability

Supply chain sustainability is a business issue affecting an organisation’s supply chain or logistics network and is frequently quantified by comparison with SECH ratings. SECH ratings are defined as social, ethical, cultural and health footprints. Consumers have become more aware of the environmental impact of their purchases and companies’ SECH ratings and, along with non-governmental organisations ([NGO)s], are setting the agenda for transitions to organically-grown foods, anti-sweatshop labour codes and locally-produced goods that support independent and small businesses. Because supply chains frequently account for over 75% of a company’s carbon footprint many organisations are exploring how they can reduce this and thus improve their SECH rating.

Components of Supply Chain Management Integration

The management components of SCM

The SCM components are the third element of the four-square circulation framework. 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 (Ellram and Cooper, 1990; Houlihan, 1985). 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 re-
engineering, buyer-supplier relationships, and SCM suggests various possible components that must receive managerial attention when managing supply relationships. Lambert and Cooper (2000) identified the following components which are:

* 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
* Culture and attitude

However, a more careful examination of the existing literature will lead us to a more comprehensive structure of what should be the key critical supply chain components, the "branches" of the previous identified supply chain business processes, that is, what kind of relationship the components may have that are related with suppliers and customers accordingly. Bowersox and Closs states that the emphasis on cooperation represents the synergism leading to the highest level of joint achievement (Bowersox and Closs, 1996). A primary level channel participant is a business that is willing to participate in the inventory ownership responsibility or assume other aspects of financial risk, thus including primary level components (Bowersox and Closs, 1996). A secondary level participant (specialized), is a business that participates in channel relationships by performing essential services for primary participants, thus including secondary level components, which are in support of primary participants. Third level channel participants and components that will support the primary level channel participants, and which are the fundamental branches of the secondary level components, may also be included.

Consequently, Lambert and Cooper's framework of supply chain components does not lead us to the conclusion about what are the primary or secondary (specialized) level supply chain components (see Bowersox and Closs, 1996, p.g. 93). That is, what supply chain components should be viewed as primary or secondary, how these components should be structured in order to have a more comprehensive supply chain structure, and to examine the supply chain as an integrative one (See above sections 2.1 and 3.1).

Reverse Supply Chain Reverse logistics is the process of planning, implementing and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal. Reverse logistics is also referred to as "Aftermarket Customer Services". In other words, anytime money is taken from a company's Warranty Reserve or Service Logistics budget, that is a Reverse Logistics
operation.