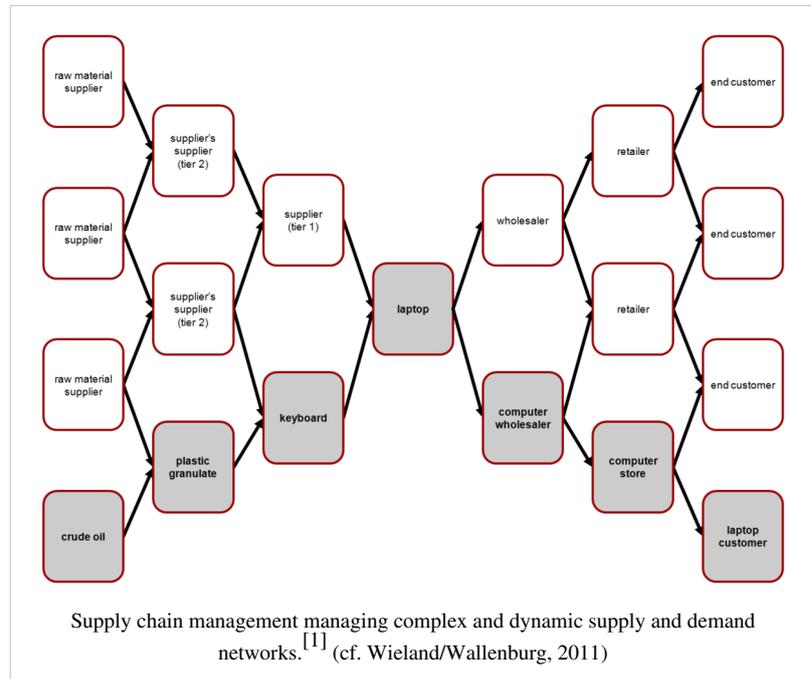


Supply chain management

Supply chain management (SCM) is the management of a network of interconnected businesses involved in the provision of product and service packages required by the end customers in a supply chain.^[2] 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.

Another definition is provided by the APICS Dictionary when it defines SCM as the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally."



Origin of the term and definitions

The term "supply chain management" entered the public domain when Keith Oliver, a consultant at Booz Allen Hamilton, used it in an interview for the Financial Times in 1982. The term was slow to take hold and the lexicon was slow to change. It gained currency in the mid-1990s, when a flurry of articles and books came out on the subject. In the late 1990s it rose to prominence as a management buzzword, and operations managers began to use it in their titles with increasing regularity.^{[3][4][5]}

Common and accepted definitions of supply chain management are:

- Managing upstream and down stream value added flow of materials, final goods and related information among suppliers; company; resellers; final consumers is supply chain management.
- Supply chain management is the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer *et al.*, 2001).^[6]
- A customer focused definition is given by Hines (2004:p76) "Supply chain strategies require a total systems view of the linkages in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence costs must be lowered throughout the chain by driving out unnecessary costs and focusing attention on adding value. Throughput efficiency must be increased, bottlenecks removed and performance measurement must focus on total systems efficiency and equitable reward distribution to those in the supply chain adding value. The supply chain system must be responsive to customer requirements."^[7]
- Global supply chain forum - supply chain management is the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders (Lambert, 2008).^[8]

- According to the Council of Supply Chain Management Professionals (CSCMP), supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of 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 cooperate to provide product and service offerings has been called the *Extended Enterprise*.

A supply chain, as opposed to supply chain management, is a set of organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer. Managing a supply chain is 'supply chain management' (Mentzer *et al.*, 2001).^[6]

Supply chain management software includes tools or modules used to execute supply chain transactions, manage supplier relationships and control associated business processes.

Supply chain event management (abbreviated as SCEM) is a consideration of all possible events and factors that can disrupt a supply chain. With SCEM possible scenarios can be created and solutions devised.

In many cases the supply chain includes the collection of goods after consumer use for recycling. Including 3PL or other gathering agencies as part of the RM re-patriation process is a way of illustrating the new end-game strategy.

Problems addressed

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:** questions of operating control (centralized, decentralized or shared); delivery scheme, e.g., direct shipment, pool point shipping, cross docking, direct store delivery (DSD), closed loop shipping; mode of transportation, e.g., motor carrier, including truckload, Less than truckload (LTL), parcel; railroad; intermodal transport, including trailer on flatcar (TOFC) and container on flatcar (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 third-party logistics (3PL)).
- **Trade-Offs in Logistical Activities:** The above activities must be well coordinated in order to achieve the lowest total logistics cost. Trade-offs may increase the total cost if only one of the activities is optimized. For example, full truckload (FTL) rates are more economical on a cost per pallet basis than 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 processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, potential collaboration, etc.
- **Inventory Management:** Quantity and location of inventory, including raw materials, work-in-process (WIP) and finished goods.
- **Cash-Flow:** Arranging the payment terms and methodologies for exchanging funds across entities within the supply chain.

Supply chain execution means 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 including managing the movement of raw materials into an organization, certain aspects of the internal processing of materials into finished goods, and the movement of finished goods out of the organization and toward the end-consumer. As organizations strive to focus on core competencies and becoming more flexible, they reduce 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 the velocity of inventory movement.

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. The CSCMP has adopted The American Productivity & Quality Center (APQC) Process Classification FrameworkSM a high-level, industry-neutral enterprise process model that allows organizations to see their business processes from a cross-industry viewpoint.^[9]

Strategic level

- Strategic network optimization, including the number, location, and size of warehousing, distribution centers, and facilities.
- Strategic partnerships 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 activities.
- Segmentation of products and customers to guide alignment of corporate objectives with manufacturing and distribution strategy.
- Information technology chain operations.
- Where-to-make and make-buy decisions.
- Aligning overall organizational strategy with supply strategy.
- It is for long term and needs resource commitment.

Tactical level

- 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 and Habits.
-

Operational level

- 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.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.
- From production level to supply level accounting all transit damage cases & arrange to settlement at customer level by maintaining company loss through insurance company.
- Managing non-moving, short-dated inventory and avoiding more products to go **short-dated**.

Importance

Organizations increasingly find that they must rely on effective supply chains, or networks, to compete in the global market and networked economy.^[10] 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, significant success factors were identified, complementing the earlier "Just-In-Time", Lean Manufacturing and Agile manufacturing practices.^[11] 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".^[12] 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 chains is described in ISO/IEC 28000 and ISO/IEC 28001 and related standards published jointly by ISO and IEC

Historical developments

Six major movements can be observed in the evolution of supply chain management studies: Creation, Integration, and Globalization (Movahedi et al., 2009), Specialization Phases One and Two, and SCM 2.0.

Creation era

The term **supply chain management** was first coined by Keith Oliver in 1982. However, the concept of a supply chain in management was of great importance long before, in the early 20th century, especially with 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.

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 supply chain evolution is characterized by both increasing value-adding and cost reductions through integration.

In fact a supply chain can be classified as a Stage 1, 2 or 3 network. In stage 1 type supply chain, various systems such as Make, Storage, Distribution, Material control, etc. are not linked and are independent of each other. In a stage 2 supply chain, these are integrated under one plan and is ERP enabled. A stage 3 supply chain is one in which vertical integration with the suppliers in upstream direction and customers in downstream direction is achieved. An example of this kind of supply chain is Tesco.

Globalization era

The third movement of supply chain management development, the globalization era, can be characterized by the attention given to global systems of supplier relationships and the expansion of supply chains over national boundaries and into other continents. Although the use of global sources in the supply chain of organizations can be traced back several decades (e.g., in 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 their competitive advantage, value-adding, and reducing costs through global sourcing. However it was not until the late 1980s that a considerable number of organizations started to integrate global sources into their core business.

Specialization era (phase I): 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 company 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.

Specialization era (phase II): 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 from suppliers, logistics providers, locations and customers, and from any number of these specialized participants as components of supply chain networks. This variability has significant effects on the supply chain infrastructure, from the foundation layers of establishing and managing the electronic communication between the trading partners to 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 specific, best-in-class partners to contribute to the overall value chain itself, thereby 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 primarily in transportation and collaboration categories. 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 currently in focus today.

Supply chain management 2.0 (SCM 2.0)

Building on globalization and specialization, the term 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 to help navigate the vast amount of information available on the Web in order to find what is being sought. 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, a 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 through intimate understanding of how to manage these elements to achieve desired results. Finally, the solutions are delivered in a variety of options, such 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.

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 known. The marketing department, responding to customer demand, communicates with several distributors and retailers as it attempts to determine ways to satisfy this demand. Information shared 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 a 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)^[13] are:

- Customer relationship management
- Customer service management
- Demand management style
- 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, which 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 which combine these processes stated by Lambert such as:

- a. Customer service management
 - b. Procurement
 - c. Product development and commercialization
 - d. Manufacturing flow management/support
 - e. Physical distribution
 - f. Outsourcing/partnerships
 - g. Performance measurement
 - h. Warehousing management
- a) Customer service management process

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

- determine mutually satisfying goals for organization and customers
- establish and maintain customer rapport
- produce positive feelings in the organization and the customers

b) Procurement process

Strategic plans are drawn up with suppliers to support the manufacturing flow management process and the 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 a reduction in time required for

the design cycle and product development. Also, the purchasing function develops rapid communication systems, such as electronic data interchange (EDI) and Internet linkage to convey possible requirements more rapidly. Activities related to obtaining products and materials from outside suppliers involve resource planning, supply sourcing, negotiation, order placement, inbound transportation, storage, handling and quality assurance, many of which include the responsibility to coordinate with suppliers on matters of scheduling, supply continuity, hedging, and research into new sources or programs.

c) Product development and commercialization

Here, customers and suppliers must be integrated into the product development process in order to reduce time to market. As product life cycles shorten, the appropriate products must be developed and successfully launched with 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 produces 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 in meeting customer demand. 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 outsource everything else. 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, managing and controlling 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. Taking advantage of supplier capabilities and emphasizing a long-term supply chain perspective in customer relationships can both be 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.

h) Warehousing management

As a case of reducing company cost & expenses, warehousing management is carrying the valuable role against operations. In case of perfect storing & office with all convenient facilities in company level, reducing manpower cost, dispatching authority with on time delivery, loading & unloading facilities with proper area, area for service station, stock management system etc.

Components of supply chain management are as follows: 1. Standardization 2. Postponement 3. Customization

Theories

Currently there is a gap in the literature available on supply chain management studies: there is no theoretical support for explaining the existence and the boundaries of supply chain management. A few authors such as Halldorsson, et al. (2003), Ketchen and Hult (2006) and Lavassani, et al. (2009) have tried to provide theoretical foundations for different areas related to supply chain by employing organizational theories. These theories include:

- 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)
- Materials Logistics Management (MLM)
- Just-in-Time (JIT)
- Material Requirements Planning (MRP)
- Theory of Constraints (TOC)
- Performance Information Procurement Systems (PIPS) ^[14]
- Performance Information Risk Management System (PIRMS) ^[14]
- Total Quality Management (TQM)
- Agile Manufacturing
- Time Based Competition (TBC)
- Quick Response Manufacturing (QRM)
- Customer Relationship Management (CRM)
- Requirements Chain Management (RCM)
- Available-to-promise (ATP)
- and many more

However, the unit of analysis of most of these theories is not the system “supply chain”, but another system such as the “firm” or the “supplier/buyer relationship”. Among the few exceptions is the relational view, which outlines a theory for considering dyads and networks of firms as a key unit of analysis for explaining superior individual firm performance (Dyer and Singh, 1998).^[15]

Supply chain centroids

In the study of supply chain management, the concept of centroids has become an important economic consideration. A centroid is a place that has a high proportion of a country’s population and a high proportion of its manufacturing, generally within 500 mi (805 km). In the U.S., two major supply chain centroids have been defined, one near Dayton, Ohio and a second near Riverside, California.

The centroid near Dayton is particularly important because it is closest to the population center of the US and Canada. Dayton is within 500 miles of 60% of the population and manufacturing capacity of the U.S., as well as 60 percent of Canada’s population.^[16] The region includes the Interstate 70/75 interchange, which is one of the busiest in the nation with 154,000 vehicles passing through in a day. Of those, anywhere between 30 percent and 35 percent are trucks hauling goods. In addition, the I-75 corridor is home to the busiest north-south rail route east of the Mississippi.^[16]

Tax efficient supply chain management

Tax efficient supply chain management is a business model which considers the effect of tax in design and implementation of supply chain management. As the consequence of globalization, businesses which are cross-national should pay different tax rates in different countries. Due to the differences, global players have the opportunity to calculate and optimize supply chain based on tax efficiency^[17] legally. It is used as a method of gaining more profit for company which owns global supply chain.

Supply chain sustainability

Supply chain sustainability is a business issue affecting an organization’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 organizations(NGOs), are setting the agenda for transitions to organically-grown foods, anti-sweatshop labor 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 organizations are exploring how they can reduce this and thus improve their SECH rating.

For example, in July, 2009 the U.S. based Wal-Mart corporation announced its intentions to create a global sustainability index that would rate products according to the environmental and social impact made while the products were manufactured and distributed. The sustainability rating index is intended to create environmental accountability in Wal-Mart’s supply chain, and provide the motivation and infrastructure for other retail industry companies to do the same.^[18]

More recently, the US Dodd-Frank Wall Street Reform and Consumer Protection Act signed into law by President Obama in July 2010, contained a supply chain sustainability provision in the form of the Conflict Minerals law. This law requires SEC-regulated companies to conduct third party audits of the company supply chains, determine whether any tin, tantalum, tungsten or gold (together referred to as *conflict minerals*) is made of ore mined/sourced from the Democratic Republic of the Congo (DRC), and create a report (available to the general public and SEC) detailing the supply chain due diligence efforts undertaken and the results of the audit.^[19] Of course, the chain of suppliers/vendors to these reporting companies will be expected to provide appropriate supporting information.

Components

Management components

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,^[20] buyer-supplier relationships,^[21] and SCM^[22] suggests various possible components that must receive managerial attention when managing supply relationships. Lambert and Cooper (2000) identified the following components:

- 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^[23] leads to a more comprehensive understanding 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 to suppliers and customers. 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, including secondary level components, which support primary participants. Third level channel participants and components that support the primary level channel participants and 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 to any conclusion about what are the primary or secondary (specialized) level supply chain components (see Bowersox and Closs, 1996, p. 93). That is, what supply chain components should be viewed as primary or secondary, how should these components be structured in order to have a more comprehensive supply chain structure, and how 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 managing the return of goods. 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 one can speak of a reverse logistics operation.

Systems and value

Supply chain systems configure value for those that organize the networks. Value is the additional revenue over and above the costs of building the network. Co-creating value and sharing the benefits appropriately to encourage effective participation is a key challenge for any supply system. Tony Hines defines value as follows: "Ultimately it is the customer who pays the price for service delivered that confirms value and not the producer who simply adds

cost until that point”^[7]

Global applications

Global supply chains pose challenges regarding both quantity and value:

Supply and value chain trends

- Globalization
- Increased cross border sourcing
- Collaboration for parts of value chain with low-cost providers
- Shared service centers for logistical and administrative functions
- Increasingly global operations, which require increasingly global coordination and planning to achieve global optimums
- Complex problems involve also midsized companies to an increasing degree,

These trends have many benefits for manufacturers because they make possible larger lot sizes, lower taxes, and better environments (culture, infrastructure, special tax zones, sophisticated OEM) for their products. Meanwhile, on top of the problems recognized in supply chain management, there will be many more challenges when the scope of supply chains is global. This is because with a supply chain of a larger scope, the lead time is much longer. Furthermore, there are more issues involved such as multi-currencies, different policies and different laws. The consequent problems include: 1. different currencies and valuations in different countries; 2. different tax laws (Tax Efficient Supply Chain Management); 3. different trading protocols; 4. lack of transparency of cost and profit.

Certification

There are several certification programmes for Supply Chain Management staff development including APICS (the Association for Operations Management), ISCEA (The International Supply Chain Education Alliance) and IOSCM (Institute of Supply Chain Management). APICS' certification is called Certified Supply Chain Professional, or CSCP, and ISCEA'S certification is called the Certified Supply Chain Manager (CSCM). Another, the Institute for Supply Management, is developing one called the Certified Professional in Supply Management (CPSM)^[24] focused on the Procurement and Sourcing areas of Supply Chain Management, also called Supply management. Purchasing Management Association of Canada is the main certifying body for Canada with the designations having global recipricocity. The designation Supply Chain Management Professional (SCMP) is the main designation with several others that progress toward the SCMP.

Topics addressed by selected professional supply chain certification programmes: ^{[25][26]} (updated)

Awarding Body	Institute for Supply Management (ISM) Certified Purchasing Manager (CPM)	Institute for Supply Management (ISM) Certified Professional in Supply Management (CPSM)	The Association for Operations Management (APICS) Certified Production and Inventory Management (CPIM)	The Association for Operations Management (APICS) Certified Supply Chain Professional (CSCP)	American Society of Transportation and Logistics (AST&L) Certification in Transportation and Logistics (CTL)	International Supply Chain Education Alliance (ISCEA) Certified Supply Chain Manager (CSCM)	International Supply Chain Education Alliance (ISCEA) Certified Supply Chain Analyst (CSCA)	Institute of Supply Chain Management (IOSCM)
Procurement	High	High	Low	High	Low	High	High	High
Strategic Sourcing	Low	High	Low	Low	Low	High	Low	Low

New Product Development	Low	High	Low	High	Low	Low	Low	Low
Production, Lot Sizing	Low	Low	High	Low	High	Low	Low	High
Quality	High	High	High	High	Low	Low	Low	High
Lean Six Sigma	Low	Low	Low	Low	Low	High	High	Low
Inventory Management	High							
Warehouse Management	Low	Low	Low	Low	High	Low	High	High
Network Design	Low	Low	High	Low	High	High	High	Low
Transportation	High	Low	High	Low	High	High	High	High
Demand Management, S&OP	Low	High						
Integrated SCM	High	Low	Low	High	High	High	High	High
CRM, Customer Service	Low	Low	Low	High	Low	High	Low	High
Pricing	Low	Low	Low	Low	Low	Yes	Yes	Low
Risk Management	Low	High	High	Low	Low	Low	Low	High
Project Management	Low	High	High	Low	Low	Yes	Low	High
Leadership, People Management	High	High	High	Low	Low	High	Low	High
Technology	High	Low	Low	High	High	High	High	High
Theory of Constraints	Low	Low	Low	Low	Low	High	High	Low
Operational Accounting	High	High	Low	Low	Low	High	Low	Low

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- CIO Magazine's ABCs of supply chain management (<http://www.cio.com/article/40940>)

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