A SYSTEMATIC REVIEW OF EXISTING SUPPLY CHAIN MANAGEMENT: DEFINITION, FRAMEWORK AND KEY FACTOR

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ABSTRACT

Supply chain management (SCM) is not a static concept or solution, continuous advances and innovative applications of SCM are proposed every day. SCM is not a concept without problems. These problems include the lack of a universally accepted definition of SCM, the existence of several different and competing frameworks for SCM and Key factor. Each organization has its unique supply chain structure so the critical factors that influence its performance also vary from organization to organization. Hence, this study focused on review of the existing SCM strategies adopted by different sectors.

The purpose for this paper is therefore to bring critical review of SCM by exploring some of the more prevalent SCM definitions, frameworks and Key Factor.

INTRODUCTION

In recent years the topic of Sustainable Supply Chain Management (SCM) has received growing attention and has become an increasingly popular research area. A basic supply chain consist of a firm, an immediate supplier and an immediate customer directly linked by one or more of the upstream and downstream flows of products, services and information. SCM is all about delivering the right products/services at the right place at right
time in right quantities. Conventionally, the sales/marketing and distribution teams do not possess adequate information necessary for decision making regarding the stock demands required to meet customer’s demands. To counter this problem, the concept of supply chain orientation plays a vital role, where the firm is expected to understand and recognize the systematic and strategic implications of the business activities and processes involved in managing various flows regarding the information component of supply chain. In today's competitive business environment, companies must tackle multiple new challenges and need to interact constantly with the customers as well as manufacturers. This means that, in order to produce goods tailored to customer's requirements and provide faster deliveries, industry must be closely linked to suppliers and customers. In order to achieve this improved delivery performance, reduced lead times within the industries and improved efficiency and operational effectiveness, manufacturers need to have efficient planning & control systems that enable very good synchronization and planning in all the activities of the organization. In the backdrop of above information, an attempt has been made to unearth the various ways in which SCM applications are utilized in different industrial sectors.

1. SCM DEFINITIONS

The first SCM definition in our review is provided by the Council of Supply Chain Management Professionals (CSCMP). CSCMP refers to itself as the preeminent worldwide professional association of supply chain management professionals with a vision to “lead the evolving supply chain management profession by developing, advancing, and disseminating supply chain knowledge and research”. CMCSp defines SCM as “encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all 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” (www.cscmp.org). However, CSCMP also state the supply chain management (SCM) profession has continued to change and evolve to fit the needs of the growing global supply chain. With the supply chain covering a broad range of disciplines, the definition of what is a supply chain can be unclear. Often times SCM can be confused with the term logistics management. The second definition is provided by the Global Supply Chain Forum (GSCF). GSCF defines SCM as: “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.” (Lambert et al, 1998, p.1). On the forum website, they also write: “Supply Chain Management is not a business function; rather it is a new business model necessary for an organization's success and everyone in the organization needs to be involved” (www.scm-institute.org). However, implementation of this definition into the practice represents a difficult and challenging task as there is a significant degree of complexity related to management of all tiers of suppliers back to the point of origin and all tiers of customers out to the point of consumption (Lambert et al, 1998).

Our final definition is provided by Stock and Boyer (2009). Their definition is based on a synthesis of a wide range of suggestions provided by a variety of practitioner, academic and hybrid sources. They deconstructed the commonalities in all the reviewed suggestions in order to develop their definition of SCM as: “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of
material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction” (Stock and Boyer 2009, p.706). Scott and Westbrook (1991) and New and Payne (1995) describe supply chain management as the chain linking each element of the manufacturing and supply process from raw materials through to the end user, encompassing several organizational boundaries. According to this broad definition, supply chain management encompasses the entire value chain and addresses materials and supply management from the extraction of raw materials to its end of useful life. Baatz (1995) further expands supply chain management to include recycling or re-use. Fig. 1 shows the activities and firms involve in such a value chain as portrayed by New and Payne (1995). It begins with the extraction of raw materials or minerals from the earth, through the manufacturers, wholesalers, retailers, and the final users. Where appropriate, supply chain management also encompasses recycling or re-use of the products or materials. Supply chain management appears to treat all organizations within the value chain as a unified ‘virtual business’ entity. It includes activities such as planning, product design and development, sourcing, manufacturing, fabrication, assembly, transportation, warehousing, distribution, and post delivery customer support. In a truly integrated supply chain, the final consumers pull the inventory through the value chain instead of the manufacturer pushing the items to the end users.

2. SCM FRAMEWORKS

SCM frameworks should serve as a point of reference for researchers and managers. There are four frameworks: the Supply Chain Operations Reference (SCOR) model, the Global Supply Chain Forum (GSCF) framework, the Collaborative Planning, Forecasting, and Replenishment (CPFR) tool and a framework developed by Mentzer et al. (2001). In our review, we include only one framework: the Supply Chain Operations Reference (SCOR) model. We exclude three frameworks due to lack of significant detailed level description. In the following sections we describe only one framework among four of them.

Supply Chain Operations Reference (SCOR)

The Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council (SCC) and AMR Research in 1996 is the most commonly cited SCM framework (Lochamy and McCormack 2004). SCC describes itself as “an independent, not-for-profit, global corporation with membership open to all companies and organizations.
interested in applying and advancing the state-of-the-art in supply chain management systems and practices. The SCOR-model captures the Council’s consensus view of supply chain management.” ([www.supply-chain.org](http://www.supply-chain.org)). The SCOR model “provides a unique framework that links business processes, metrics, best practices and technology features into a unified structure to support communication among supply chain partners and to improve the effectiveness of supply chain management and related supply chain improvement activities” (Supply Chain Council, 2009). According to the SCC, SCOR is used to identify measure, reorganize and improve supply chain processes through a cyclical process that includes:

1. Capturing the configuration of a supply chain
2. Measuring the performance of the supply chain and comparing against internal and external industry goals
3. Re-aligning supply chain processes and best practices to fulfill unachieved or changing business objectives

Through the completion of the steps outlined above, the SCOR model aims to integrate well-known concepts such as business process reengineering, benchmarking, and process measurement into a cross functional framework (Huan et al. 2004). When originally developed in 1996, four core business processes – plan, source, make, and deliver – served as the foundation of the SCOR model. Later, in 2001, a fifth process – return – was added to enhance the validity of the model. Each of these processes is implemented through four individual levels. The first level defines the scope and content of the model itself, as well as specifying basis for competition performance targets. At level two, companies implement their operations strategies dependent upon the configurations they choose for their supply chains. Level three defines inputs, outputs, and flows of each transactional element, and finally, level four defines the implementation of specific supply chain management practices (Lockamy and McCormack 2004). The source, make, and deliver processes of the SCOR model create a continuous chain of activity throughout a company’s internal operations and, potentially, across the whole inter-organizational supply chain. One also could argue that the framework includes a high level planning process, which balances aggregate demand and supply to develop a course of action that best meets the requirements of the source, make, and deliver processes (Lambert et al. 2005).
3. SUPPLY CHAIN MANAGEMENT – KEY FACTORS

3.1 Inbound and outbound logistics

All components/parts and products within the supply chain have to be delivered to factories, distributors, and customers. However, the choice of the transport mode (air, sea, or land) affects all other areas of SCM, such as warehousing, production, packaging, planning, location (of suppliers, manufacturing, and customers), inventory control, and information management [1]. Therefore, factors, such as transit time, reliability, accessibility, security, impact on inventory, product degradation or obsolescence, traceability, and so on are important.

Once the carrier is selected, computer models are used to optimize routing. The previous studies have shown that the overall effectiveness of the shipping function is a major way to reduce costs [2]. More recently, managing the reverse flow of products has become an important ability. Reverse Logistics is the management of the reverse flow of products. This includes customer dissatisfaction with the product or at the end of the product life cycle, when the product is returned for recycling. This concept of reverse logistics has become an important strategic advantage for companies, and is driven by losses from customer dissatisfaction returns, or the cost and challenges of recycling. Both activities, if managed well, have great potential to augment customer satisfaction.

3.2 Planning: Sales and production planning (collaborative planning and generating demand)

All manufacturing or supply of services starts with a forecast of demand. However, the major problem with forecasting is the errors associated with it, which can significantly increase the business losses (if forecast is low) or high inventories (if forecast is too high). Forecast errors lead to the “bullwhip” effect and can cause excessive inventories, poor customer service, lost revenues, misguided capacity plans, and missed production schedules [3]. Furthermore, suppliers often push products to market, but more recently the retailers are interested in stocking only what the consumer will buy. The probable solution to the “bullwhip” effect is supply chain collaboration – an activity requiring two or more companies to share the responsibility of exchanging common planning, management, execution, and performance measurement information [4]. Typically, the process is to get data from POS (point of sales) systems, which is sent back to the warehouse or manufacturer, who arranges for quick replenishment [3], [5]. Consequently, production volumes and subsequent sales to retailers are based on sell-through information, planned promotions, and seasonal forecasts using statistical models. The sell-through data are used to replenish products at a retailer through a process called continuous replenishment. Hence, if a company has the ability to understand real-time market demand and respond quickly, it is possible to manufacture only what sells in the market [3]. This continuous replenishment process, or the synchronized supply chain as it is often called, has spread from the Supermarket sector to the automobile industry, but barriers remain including lack of scalability and critical mass, managing exceptions, and managing promotions [6]. Apart from the above mentioned hurdles in the implementation of continuous replenishment approach, the human resource and technology related aspects would also contribute in its lesser utilization.
3.3 Purchasing, strategic sourcing, vendor management, collaboration and bidding via the supply chain

With accurate dynamic forecasts made from customer demand and promotions, the correct raw material inventory can be stocked. Furthermore, purchasing becomes a strategic function – hence strategic sourcing needs to be initiated to reorganize the company’s supply base for materials and services, in order to reduce external expenditures and internal processing costs [7]. Aggressive companies have partnered with suppliers to reduce the number of suppliers by 40% to 85% [5],[7]. This supplier reduction approach also reduces internal processing costs as larger orders go to fewer suppliers. In addition, aggressive companies review their supplier’s cost structure and technical capabilities in order to select the best supplier. They also set up internal supply management teams to manage the supply process [8]. These initiatives result in higher volumes with better prices and quality from the short-listed suppliers [8].

Inventory Management

Historically, there is a strong emphasis on asset management via lower inventories and warehouse space. Companies recognize that product inventories are expensive to hold. Therefore many companies have implemented just-in-time (JIT) deliveries of parts, a methodology initially implemented by Toyota Motor Company [9]. Some companies have been more aggressive and have implemented vendor-managed inventory (VMI). For example Apple Computer Inc. has set up a partnering deal with suppliers. A supplier keeps inventory in the warehouse on consignment and moves it to the factory on demand – only then is it considered sold [10].

Moreover, inventory occupies warehouse space, which is costly – therefore there is a drive to reduce multiple warehouses. Hence, regional distribution centers (RDCs), instead of a warehouse in every big city, have become popular [1]. For example, Philips has reduced its warehouses for consumer products from 22 to 4 in Europe [11]. However, the location of RDCs is very critical and decides whether the company can minimize the costs. Furthermore, the RDCs are often responsible for longer delivery cycles, but this effect can be compensated with supply chain programs like continuous replenishment. The next step in inventory management is development of a centralized information system, to facilitate distribution of goods across and within regions. The information systems are critical in providing the vital availability information and create a virtual inventory that is accessible to all involved parties [12].

Manufacturing techniques, mass customization of products, and outsourcing

Japanese companies led by the automobile industry have implemented lean manufacturing techniques, for example kanban manufacturing and just in time (JIT) delivery of parts. These manufacturing techniques are responsible for lower inventories, better deliveries, and lower costs compared to other competitors [13]. Another approach to lower costs is outsourcing of manufacturing and manufacturing closer to the customers and large markets. The primary reason for this is that in every industry customers expect greater customization of products and services to meet their individual needs [14,15]. To meet these needs, companies are pursuing a supply chain compression strategy [14]. Some of the strategies pursued by companies are [14, 16].
**Intra-company postponement:**
Moving final product configuration from factory to distribution centers in selected markets. This solution requires a modular product design, which allows last minute customization, to meet customer, at a distribution center near the customer.

**Inter-company postponement:** i.e. moving final product configuration downstream to a channel partner, intermediary, or retailer.

**Sales agent model:** moving all inventory to the assembler, and allowing the channel and reseller to focus on sales.

**Direct model:** the assembler is responsible for order processing and delivery, thereby eliminating the distributor and reseller, and sales channel.

**Outsourcing:** companies are realizing that manufacturing (especially of low-value added activity) is not a core competency. Outsourcing of such activity can reduce costs and increase productivity per employee.

Any one of the above mentioned strategies is able to save significant costs and improve return on investment. Depending on which strategy is used, some companies have shown an increase in EVA (Economic Value Added) of 70 to 470 million dollars [14].

**Order and information management of products and services**

Since 1995, with the advent of information and computing technology, many companies have started to share as well as transmit information, transmit orders, and purchase parts and products via Electronic Data Interchange (EDI) or the Internet [1999]. EDI has been available for many years, however, its use is limited to big companies and is too costly for smaller companies or retailers. However with the introduction of the Internet, almost any firm is able to become an electronic commerce player. Activities provided via the Internet include inventory information, catalogs and prices, order management, shipping information, and product returns management [17]. The benefits of electronic commerce to a firm include quicker and more accurate capture of orders, quicker verification and transmission of orders, better communications, and quicker payments.

**The Internet enabled supply chain and integration of the entire supply chain**

The different factors of the supply chain (such as planning, purchasing, manufacturing, order and management, warehouse management, and logistics) have posed formidable challenge because often many activities in company are adopted and introduced ad-hoc. However, the rapid development pace of powerful information technology systems has potential to provide solutions towards better integration.

**Integration of entire supply chain via a computer network**

The different factors of the SCM evolved over the years with different pace. These factors are needed to be linked together to ensure optimization of resources and costs. As a result, new age software vendors have come up with innovative solutions to provide this synergy, synchronization, and optimization of the supply chain. In 1999, there were at least 14 enterprise-wide (supply chain) software solutions available [18]. The linkages span the supply chain from the consumer to the supplier. Good integration involves coordination of the following: demand information, inventory status, capacity plans, production schedules, promotion plans, demand forecasts, shipment schedules and replenishment processes [19]. The benefit of integration is the creation of supply chain that reads customer demand and responds quickly to customer and market needs. Such a lean and responsive system is, in
theory, able to shorten time to do anything and have a shorter cash to cash cycle [20, 21]. With SCM integration it is possible to improve inter-organizational level coordination and hence move towards optimization of the supply chain [22].

**Successful integration via Efficient Consumer Response (ECR) process**

One of the most effective integration solutions is ECR - it focuses on the integration of factory or vendor supply and customer demand. Specifically, it focuses on demand management, supply management, and enabling technologies that link these activities [11, 12]. ECR can coordinate new product introductions, consumer promotions, product range/variety, and replenishment. The benefit of ECR is lower cost, less inventory, and improved product availability. ECR can result in extensive collaboration between suppliers, logistics service providers, and retailers. Hence, supply chains can become demand chains, resulting in the optimum quantity of products in the market, with little or no stock-outs in the retail outlets.

**Rebuilding the supply chain**

The convergence of supply chain principles with internet has resulted in its evolution and rebuilding. The Internet makes it possible to dispense with many activities in the supply chain [23]. This dis-intermediation has reduced the role of many wholesalers and retailers as consumers have started to buy direct from manufacturers or wholesalers. However, an early prediction that this dis-intermediation will eliminate wholesalers and retailers has not happened - instead what has emerged is a change in the function of intermediaries, for example the need to add value and decrease high price mark-ups [24]. Hence, the continuous evolution and reorientation of the supply chains demands that constant efforts are necessary to rebuild the supply chains that are in line with the current business perspective.

**Internet-enabled supply chain**

A high degree of coordination and integration of the various factors of supply chain is possible with the advent of the Internet. The Internet provides the basic platform to initiate, propagate, support e-commerce, and synchronize the entire supply chain. Drucker [25] has said that in future, with e-commerce and the Internet, companies will sell only what they can deliver, which will put a high dependency on SCM. Some of the activities that are possible via the Internet are [11, 21, 23, 24 and 26]:

- Information about product, service, catalogues, and pricing data
- Customer communication, order management, acknowledgement, and service.
- Supplier communication, data sharing, and purchase orders
- Financial transactions between the firm and its suppliers and customers
- Electronic delivery of products and services
- Rebuilding of the supply chain

However, the Internet is only a tool to better synchronize and facilitate supply chain management and cannot replace it – however, the outcome will be lower costs, higher speed, and increased customer satisfaction [14].

**The E-supply chain**

The Internet enabled supply chain becomes an E (or Electronic) supply chain. The E-supply chain can connect the entire organization from raw material vendors, purchasing, planning, manufacturing, logistics, marketing, customer care and service, and human
resources. Such a system is able to meet the customer’s changing demand quickly and meet very aggressive goals in economic added value [20]. The E-supply chain can form a network, which will allow for collaboration with all the partners of a firm and links all the important information in a firm, including but not limited to cash flow and order management, to those members of the supply chain that most need it. However, the greatest challenge is data quality and good information exchange and better integration to create a truly virtual E-supply chain and the cost benefits can be envisaged only if these objectives are achieved [27]. Nevertheless, the E-supply chain dimension of E-business is largely neglected and under-practiced, and hence it is difficult to make E-business into a reality. In fact one researcher argues that the E-supply chain is virtually non-existing [27], which may be due to the quality and quantity of technically competent human resource as well as the availability of latest computing infrastructures.

Electronic delivery of products and services

The convergence of the Supply Chain with the Internet allows immediate delivery of certain products and services, which can be transmitted electronically. These include music, documents and books (via data files), software, event and travel tickets, stock transactions, on-line diagnosis of computers and their peripherals, and banking services, e.g. loans and payments [23].

3.4 SCM Information Systems

The linkages of supply chain factors via computer systems using enterprise resource planning systems or the Internet also provide another benefit - access to information throughout the supply chain. Some of the benefits and advances are:

Visibility across the entire supply chain: SCM information systems are able to provide complete visibility across the entire supply chain. Available information includes [11, 22, 24 and 26]:

• Product and marketing information, catalogues, and pricing data
• Customer communication, order management, acknowledgement, and service.
• Supplier communication, data interchange, and purchase orders
• Provide complete visibility across entire chain
• Ability to track specific projects, production runs and cycle times
• Inventory buckets at suppliers, in transit, receiving docks, work-in-process, finished goods, and at distributors
• Product or goods delivery information
• Ability to track local to worldwide information of above factors
• Provide real time information of all above factors
• A crucial area that improves with good SCM information systems is Inter-organizational information flow – both within and between organizations.

Challenges in designing the SCM system for competitive advantage

Recent research looks at the impact of information usage on the supply chain system [28]. The researchers argue that marketplace information must move quickly from customers through the entire supply chain without delay. Information from the marketplace comes via the Internet or electronic data exchange. Such an enriched supply chain can reduce uncertainty and time delay and provide several benefits. The benefits include an increase in the speed of response in processes and reduced inventory levels. The overall result can be a
seamless and holistic supply chain, which allows a company to be more competitive. However, this research focuses on forecasting and production and the conclusions drawn are from a computer model.

3.5 Customer relationship management and SCM

Customer relationship management (CRM) has become important as customers start to demand mass customization or personalized products and services [15]. CRM is the management of technology, processes, information, and people in order to maximize each customer contact by obtaining a 360-degree view of the customer [29]. To be effective, CRM has to extend through multiple channels [30]. Effective CRM can result in high customer satisfaction, which is achieved through customization, personal relationship, and after-sales support [29]. In order to maintain competitive advantage, a company has to have an effective CRM program and integrate it tightly. Hence, the CRM aspect has to be given adequate importance while designing the SCM strategies.

CONCLUDING DISCUSSION

The field of SCM has gained in importance over the last decades and there are many signs indicating that the field will continue to grow in importance – both in terms of research and for practitioners. The current global competitive business environment demands an increased interaction between the customer and manufacture. Hence in order produce customized product and provide faster deliveries, the industry must be closely linked to suppliers and customers. SCM benefits and the required conditions necessary to achieve these benefits, such as process management and cross-functionality, breaking down silos, emphasis on customer satisfaction, process orientation, and information sharing have been discussed for decades. However, SCM also has many problems. Stock and Boyer discuss the problem with the confusion that exists amongst researchers, and practitioners, due to the multitude of suggested SCM definitions. They write “…a consensus definition of SCM is of significant importance in the advancement of SCM theory and practice.” Furthermore, while many scholars agree that SCM includes certain key concepts, such as integration and collaboration/cooperation among chain members, these concepts are still poorly defined – with multiple meanings to both researchers and practitioners. Since the mentioned concepts obviously are important to the development of SCM, they need to be further explored and defined.

For all these reasons, both the research and practitioner communities should be aware of the hype and potentially unrealistic claims concerning SCM. As our review indicates, there is a lack of empirical research to confirm the significant stated benefits of SCM. Although a majority will agree to the importance and potential benefits of SCM, somehow SCM does not seem to occur often enough in practice. Organizations appear to have significant difficulties in evolving from theory to the successful implementation and practice of supply chain management. This is a crucial yet challenging dilemma to solve. In many cases, we do not have seamless chains, optimized flows, or networks of integrated organizations. In reality, the frameworks and their corresponding terminologies, once more aptly illustrated, ultimately are dealing with companies trying to make dyadic relationships better. Therefore, we need methodical approaches to the implementation of SCM and we need sound empirically based research to continue to develop the field – and to explore the concepts related to SCM.
As a final thought, supply chain management is complex, it is often yet still poorly defined and it includes innumerable concepts and ideas that need clarification. The supply chain does not have clear roles or rules, nor does it have measurement or reward systems. How can such a structure possibly be managed?

REFERENCES

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