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1. INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) is the management of the flow of goods. It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. Here the term raw material or feedstock is the basic material from which goods, finished products or intermediate materials that are manufactured or made. The term raw material is frequently used with an extended meaning. As feedstock, the term connotes it is a bottleneck asset critical to the production of other products. For example, crude oil is a feedstock raw material providing finished products in the fuels, plastics and industrial chemicals and pharmaceuticals industries. Interconnected or interlinked networks, channels and node businesses are involved in the provision of products and services required by end customers in a supply chain. Supply chain management has been defined 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." A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials, and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains. SCM draws heavily from the areas of operations management, logistics, procurement, and information technology, and strives for an integrated approach, where the terms are explained as

- ✓ Operations management is an area of management concerned with overseeing, designing and controlling the process of production and redesigning business operations in the production of goods or services. It involves the responsibility of ensuring that business operations are efficient in terms of using as few resources as needed, and effective in terms of meeting customer requirements. It is concerned with managing the process that converts inputs (in the forms of materials, labor, and energy) into outputs (in the form of goods and/or services).

- ✓ Logistics is the management of the flow of resources between the point of origin and the point of consumption in order to meet some requirements, for example, of customers or corporations. The resources managed in logistics can include physical items, such as food, materials, equipment, liquids, and staff, as well as abstract items, such as time, information, particles, and energy. The logistics of physical items usually involves the integration of information flow, material handling, production, packaging, inventory, transportation, warehousing, and often security. The complexity of logistics can be modeled, analyzed, visualized, and optimized by dedicated simulation software. The minimization of the use of resources is a common motivation in logistics for import and export.

- ✓ Procurement is the acquisition of goods, services or works from an outside external source. It is favorable that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the purchaser in terms of quality and quantity, time, and location. Corporations and public bodies often define processes intended to promote fair and open competition for their business while minimizing exposure to fraud and collusion.

- ✓ Information technology (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, such as computer hardware, software, electronics, semiconductors, internet, telecom equipment, E-commerce and computer services.

1.1. Origin of the term and definitions:

The term "supply chain management" entered the public domain when Keith Oliver, a consultant at Booz Allen Hamilton (now Booz & Company), used it in an interview for the Financial Times in 1982. The term was slow to take hold. 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.

Commonly accepted definitions of supply chain management include:

- ✓ The management of upstream and downstream value-added flows of materials, final goods, and related information among suppliers, company, resellers, and final consumers.
- ✓ The systematic, strategic coordination of traditional business functions and tactics across all 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.
- ✓ A customer-focused definition is given by Hines —Supply chain strategies require a total systems view of the links 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 expenses, movements, and handling. The main focus is turned to efficiency and added value, or the end-user's perception of value. Efficiency must be increased, and bottlenecks removed. The measurement of performance focuses on total system efficiency and the equitable monetary reward distribution to those within the supply chain. The supply chain system must be responsive to customer requirements."
- ✓ The integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders.
- ✓ 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 coordination and collaboration with channel partners, which may be suppliers, intermediaries, third-party service providers, or customers. 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 upstream and downstream flows of products, services, finances, or information from a source to a customer. Supply chain management is the management of such a chain. Supply

chain management software includes tools or modules used to execute supply chain transactions, manage supplier relationships, and control associated business processes. Supply chain management software (SCMS) is a business term which refers to a whole range of software tools or modules used in executing supply chain transactions, managing supplier relationships and controlling associated business processes. While functionality in such systems can often be broad – it commonly includes:

- ✓ Customer requirement processing
- ✓ Purchase order processing
- ✓ Inventory management
- ✓ Goods receipt and Warehouse management
- ✓ Supplier Management/Sourcing

A requirement of many SCMS often includes forecasting. Such tools often attempt to balance the disparity between supply and demand by improving business processes and using algorithms and consumption analysis to better plan future needs. SCMS also often includes integration technology that allows organizations to trade electronically with supply chain partners. In 2012, the global supply chain management software market is estimated at $8.3 billion. The shift to global supply chain networks shifted supply chain systems to cloud-based technology. This encouraged technology that have all partners on the same software version, a single source of truth for all software, and the implementation of software technology with pay for what you use software supply chain event management (SCEM) considers 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 third-party logistics or other gathering agencies as part of the RM repatriation process is a way of illustrating the new endgame strategy.

1.2. Problems addressed

Supply chain management addresses the following problems:

Distribution network configuration: the number, location, and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks, and customers.

Distribution strategy: questions of operating control (e.g., centralized, decentralized, or shared); delivery scheme (e.g., direct shipment, pool point shipping, cross docking, direct store delivery, or 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)). A third-party logistics provider (abbreviated 3PL, or sometimes TPL) is a firm that provides service to its customers of outsourced (or "third party") logistics services for part, or all of their supply chain management functions. Third party logistics providers typically specialize in integrated operation, warehousing and transportation services that can be scaled and customized to customers' needs based on market conditions and the demands and delivery service requirements for their products and materials. Often, these services go beyond logistics and included value-added services related to the production or procurement of goods, i.e.,

services that integrate parts of the supply chain. Then the provider is called third-party supply chain management provider (3PSCM) or supply chain management service provider (SCMSP). Third Party Logistics System is a process which targets a particular Function in the management. It may be like warehousing, transportation, raw material provider, etc. According to the Council of Supply Chain Management Professionals, 3PL is defined as "a firm that provides multiple logistics services for use by customers. Preferably, these services are integrated, or bundled together, by the provider. Among the services 3PLs provide are transportation, warehousing, cross-docking, inventory management, packaging, and freight forwarding. Third-party logistics providers include freight forwarders, courier companies, as well as other companies integrating & offering subcontracted logistics and transportation services. Hertz and Alfredsson (2003) describe four categories of 3PL providers:

Standard 3PL Provider: this is the most basic form of a 3PL provider. They would perform activities such as, pick and pack, warehousing, and distribution (business) – the most basic functions of logistics. For a majority of these firms, the 3PL function is not their main activity.

Service Developer: this type of 3PL provider will offer their customers advanced value-added services such as: tracking and tracing, cross-docking, specific packaging, or providing a unique security system. A solid IT foundation and a focus on economies of scale and scope will enable this type of 3PL provider to perform these types of tasks.

The Customer Adapter: this type of 3PL provider comes in at the request of the customer and essentially takes over complete control of the company's logistics activities. The 3PL provider improves the logistics dramatically, but do not develop a new service. The customer base for this type of 3PL provider is typically quite small. (d) The Customer Developer: this is the highest level that a 3PL provider can attain with respect to its processes and activities. This occurs when the 3PL provider integrates itself with the customer and takes over their entire logistics function. These providers will have few customers, but will perform extensive and detailed tasks for them.

Trade-offs in logistical activities: The above activities must be 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 are 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. The planning of logistical activities therefore takes a systems approach. These trade-offs are key to developing the most efficient and effective logistics and SCM strategy.

Information: The integration of processes through the supply chain in order to share valuable information, including demand signals, forecasts, inventory, transportation, and potential collaboration.

Inventory management: Management of the 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. SCM applications provide real-time analytical systems that manage the flow of products and information throughout the supply chain network.

1.3. Functions of Supply Chain Management:

Supply chain management is a cross-functional approach that includes 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 firms 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 managerial control of daily logistics operations. Less control and more supply chain partners led to the creation of the concept of supply chain management. 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.

1.4. Importance of Supply Chain Management:

Organizations increasingly find that they must rely on effective supply chains, or networks, to 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. In recent decades, globalization, outsourcing, and information technology have enabled many organizations, such as Dell and Hewlett Packard, to successfully operate collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities (Scott, 1993). This inter-organisational supply network can be acknowledged as a new form of organisation. 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. Second, technological changes, particularly the dramatic fall in communication costs (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 supply network structures as a new organisational form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", "Global Production Network", and "Next Generation Manufacturing System". A keiretsu (system, series, grouping of enterprises, order of succession) is a set of companies with interlocking business

relationships and shareholdings. It is a type of informal business group. The keiretsu maintained dominance over the Japanese economy for the last half of the 20th century. The member companies own small portions of the shares in each other's companies, centered on a core bank; this system helps insulate each company from stock market fluctuations and takeover attempts, thus enabling long-term planning in innovative projects. It is a key element of the automotive industry in Japan. In general, such a structure can be defined as "a group of semi-independent organisations, 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".

The security management system for supply chains is described in ISO/IEC 28000 and ISO/IEC 28001 and related standards published jointly by the ISO and the IEC. Supply Chain Management draws heavily from the areas of operations management, logistics, procurement, and information technology, and strives for an integrated approach.