THE DEFINITIVE GUIDE TO INTEGRATED SUPPLY CHAIN MANAGEMENT

Optimize the Interaction between Supply Chain Processes, Tools, and Technologies

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Role of Transportation in SCM

A supply chain is a network of organizations that are separated by distance and time. The transportation is a key function that facilitates product flow between buyers and sellers, and allows organizations to extend the reach of their supply chains beyond local supplier capabilities and market demand. In essence, transportation involves the physical movement of goods between origin and destination points. The transportation system links geographically separated partners and facilities in a supply chain—customers, suppliers, channel members, plants, warehouses, and retail outlets—and it facilitates the creation of time and place utility in the supply chain.

The primary modes of transportation available to the logistics manager are truck, rail, air, water, and pipeline. In addition, intermodal transportation combines the use of two or more of the basic modes to move freight from its origin to the destination. Each mode has different economic and technical structures, and each can provide different qualities of link service.

Collectively, the U.S. transportation system moves approximately 12.5 billion tons of goods for businesses, valued at nearly $11.7 trillion (Bureau of Transportation Statistics, 2010). In terms of freight expense, organizations spent $760 billion for transportation services in 2010. Almost 78 percent of the total was spent on trucking services at $592 billion, which is followed by rail at 7.9 percent, air at 4.3 percent, water at 4.3 percent, forwarders at 4.2 percent, and pipeline at 1.3 percent (Coyle, Langley, Novack, & Gibson, 2013). The combined levels of freight value, volume, and spending suggest that truck, multimodal, and air transportation are premium-priced services for moving higher-value goods. In contrast, rail, water, and pipeline provide more economically priced services for lower-value commodities.

Companies have recognized the value of transportation is much greater than simply moving product from one location to another. Instead, transportation has been given strategic attention because of its role in SCM.

Transportation service availability is critical to demand fulfillment in the supply chain. No matter whether the transportation service is for moving goods between businesses or for delivering products to the end customer, reliable shipment is critical to ensure meeting customer demand. A transportation shortage would negate the organization's efforts to build and fulfill customer demand because the product inventory would not reach the stores in a timely manner. For example, Apple currently has suppliers worldwide and sells to customers all over the world from just a few plants. Transportation allows products to smoothly move across Apple's global network. Similarly, global transportation allows Wal-Mart to source products all over the world and to sell them to domestic consumers.

Transportation efficiency enhances the competitiveness of a supply chain. With efficient, effective transportation capabilities, organizations can build global supply chains that leverage low-cost sourcing opportunities and allow them to compete in new markets. In

terms of supply management, cost-effective transportation enables companies to gain access to higher-quality, lower-priced materials and realize economies of scale in production. Likewise, low-cost transportation improves demand fulfillment opportunities. By keeping transportation expenses reasonable, the total landed cost of a product (its production costs plus transportation costs and related supply chain fulfillment costs) can be competitive in multiple markets. This is particularly true in today's environment in which many companies are sourcing from and marketing to overseas countries.

Transportation service capabilities are key to meeting customer requirements. High-quality, customer-focused transportation has a direct impact on a company's capability to provide the "Seven R's of Logistics"—getting the right product, to the right customer, in the right quantity, in the right condition, at the right place, at the right time, and at the right cost. In other words, transportation service capabilities must be aligned with customer requirements. In addition, transportation can create supply chain flexibility. By working with carriers that offer a range of transit times and service options, organizations can satisfy supply chain demands for expedited, next-day service as well as more economical, standard delivery requests. Many of today's companies are using existing transportation capabilities to provide innovative services to customers. For example, retailers such as Sears and Wal-Mart now offer free store pick-up service for online orders. Such services utilize existing store deliveries to help lower customers' purchasing cost.

Transportation cost is a critical driver of supply chain design and strategy. Accounting for nearly 63 percent of all expenditures for logistics activities, transportation spending far exceeds the amount of money spent on warehousing, inventory management, order processing, and other fulfillment system expenses combined (Wilson, 2013). Thus, transportation costs must be considered during the development of supply chain strategies and processes. In addition, transportation service availability, capacity, and costs influence decisions regarding the number and location of supply chain facilities. For example, many companies attempt to avoid locating distribution facilities in the state of Florida because little freight originates in the state. Carriers compensate for the empty outbound trips by charging higher rates to move freight into Florida. Also, transportation capabilities must align with the company's strategy. Amazon.com's decisions to provide same-day delivery and expansion into the fresh grocery business require low cost and timely transportation.

Given these critical roles, proactive management of transportation processes is fundamental to the efficient and economical operation of a company's supply chain. Company leadership must consider transportation issues when developing organizational plans, integrate transportation into supply chain processes, and optimize total supply chain cost rather than minimize transportation costs. Leading organizations like Best Buy, Amazon.com, and CVS have already moved in this direction. They recognize that supply chains can achieve time and place utility only through effective transportation processes that move goods to the place desired at the time required by their customers.

To better manage the transportation function and synchronize it with other supply chain activities, it is important to recognize and overcome potential obstacles, including supply chain complexity, competing goals among supply chain partners, changing customer requirements, and limited information availability. In addition, companies must cope with the dynamic business environment and trends discussed as follows.

Increased overseas operations pose significant transportation challenges. As companies expand their operations overseas to take advantage of lower costs or explore new markets, transportation processes must connect buyers and sellers that are thousands of miles apart. The vast distances associated with the extended supply chains produce not only higher transportation costs but also higher inventory levels caused by prolonged transit times and greater potential for supply chain disruptions. Therefore, companies must consider these higher delivery and inventory carrying costs when assessing the financial benefits of global sourcing and offshore manufacturing.

The demanding service requirements of customers affect transportation practices. Instead of shipping products in economic truckload or container load quantities, companies are forced to make smaller, more frequent deliveries to stay competitive. Shrinking order cycle requirements result in higher costs for faster delivery and longer fulfillment operation hours. In addition, customers' desire for real-time shipment visibility requires significant technological investments. Often, companies must align their operations with high-quality carriers that provide a balanced mix of capacity, speed, and consistency at a reasonable cost.

Transportation capacity constraints pose another significant challenge in moving freight across the supply chain. The current infrastructure has difficulty handling growing transportation volume. Congestion at ports and on highways has become the norm in many locations. A shortage of transportation labor makes it difficult for carriers to keep pace with freight growth. These capacity issues have caused higher freight rates, shipment delays, and limited negotiating capabilities. To overcome these issues, companies must take a more collaborative, flexible approach to working with carriers.

Rising freight rates are another major concern. After many years of low freight expenses fostered by excess carrier capacity, the situation has reversed. Capacity has shrunk due to greater demand for transportation services and industry consolidation from carrier mergers, acquisitions, and bankruptcies. The remaining carriers are now in a stronger position to increase rates to cover the rising costs of labor, insurance, and other expenses. They have also added fuel surcharges to their customers' freight bill. Although companies have limited control over rate increases and surcharges, they still need to proactively control transportation spending by using lower-cost modes of transportation when feasible, maximizing equipment utilization, and consolidating freight into larger shipments.

Transportation Execution and Control

When a shipment needs to be moved across the supply chain, transportation process must be carefully planned and executed. Decisions must be made regarding shipment size, route, and delivery method; freight documents must be prepared; in-transit problems must be resolved; and service quality must be monitored. The following are the common steps in transportation execution process.

1. **Shipment preparation**—Upon completion of the planning activities, it is time to prepare shipments for handoff to carriers for delivery. The transportation manager must choose the most appropriate carrier based on the size, service requirements, and destination of a particular shipment. The goal is to minimize transportation cost and protect the shipment while meeting service commitments. To ensure maximum effectiveness in the shipment-carrier matching process, many organizations use transportation routing guides. Because transportation provides final delivery to customers, an accurate freight count and a careful inspection should be performed prior to loading. During the loading process, the freight must be stacked properly and stabilized to minimize possible in-transit damages.
2. **Freight documentation**—Shipments are accompanied by related documents that facilitate the flow of goods. Specific documentation requirements depend on the origin and destination points, the mode being used, characteristics of the freight, and the carrier handling the freight. Common documents include the bill of lading that contains the terms and conditions of the transport contract, the freight bill that serves as the carrier's invoice for freight charges applicable to a shipment, freight claims form, commercial invoice, insurance certificate, and certificate of origin.
3. **Maintain in-transit visibility**—It is important to control the freight and manage key events as product moves across the supply chain. Visibility of in-transit freight is a key facilitator of this control because it provides the location and status of the shipments. Real-time shipment data makes it possible for companies to respond to problems in the transportation process. Various technologies such as satellite tracking capabilities have greatly enhanced the in-transit visibility.
4. **Monitor service quality**—Upon completion of freight delivery, transportation managers must analyze the outcome. Carrier performance should be carefully monitored with reference to the shipping contract. A popular approach for evaluating carrier service quality is to develop standardized scorecards or evaluation reports that prioritize the opportunities to improve supply chain performance.

Generally speaking, transportation metrics fall into two primary categories: service quality and efficiency. *S*ervice quality means doing things right the first time according to

customer-defined requirements and expectations, such as consistent, on-time, and claim-free delivery. Efficiency focuses on transportation cost control. Key indicators of transportation efficiency include transportation cost per mile or per unit, asset utilization, and labor productivity.

Order Management

Effective order management is a key component of the logistics and order fulfillment process and is critical to operational efficiency and customer satisfaction. Conducting all activities relating to order management in a timely, accurate, and thorough manner can facilitate the effective coordination of company activities in other areas. Logistics decision making needs timely and accurate information related to individual customer orders. Thus, many companies place the order management function within the logistics area. In addition, the order management process significantly affects order cycle length, an important aspect of customer service. Hence, it is essential to have a better understanding of the customer order cycle process.

Key Elements of the Order Management Process

Traditionally, order management focused on the activities that occurred between order placement and receipt. However, many companies are adopting the order-to-cash (OTC) cycle concept, which includes all business activities in the order cycle plus the flow of funds back to the seller based on the invoice. The OTC concept has gained popularity because it accurately reflects the effectiveness of the order management process. During the OTC, order management activities coordinate all three major flows in a supply chain: products, information, and payment. The following sequential list provides an overview of the primary OCT major activities (Coyle et al., 2013):

1. **Order preparation**—In the initial step, the customer investigates product, pricing, and availability information to determine whether to place an order. The seller must have up-to-date information to respond quickly and accurately to the prospective buyer.
2. **Receive, enter, and validate order**—This step involves the placement and receipt of the order. This is typically accomplished through electronic data interchange (EDI), the Internet, or directly with a customer service representative who then enters the order into the seller's order management system.
3. **Reserve inventory and determine delivery date**—The seller's inventory levels are checked via the order management system to determine the best location for filling the order. After the inventory is reserved for the customer, the delivery date is set. The order is transmitted to the warehouse management system for fulfillment and to the financial system for invoice generation.

4. **Consolidate orders**—Orders are reviewed to determine opportunities for freight consolidation and batch warehouse picking. The goal is to identify order fulfillment cost efficiencies.
5. **Plan and build loads**—A delivery plan is developed around shipment size, delivery dates, and delivery method. An effort is made to optimize transportation cost within the constraints of customer delivery requirements.
6. **Route shipments**—The order is assigned to a specific route for delivery to the customer. Transportation management systems are often used to build efficient routes.
7. **Select carriers and rate shipments**—This step takes into consideration the size of shipment, destination, and delivery to determine the appropriate carrier and freight costs. Routing guides are established to facilitate consistent decision making.
8. **Receive product at warehouse**—The product is received at the distribution center. The order management system is checked to see whether the product is immediately needed to fill an open order. If so, the product is immediately combined with the on-hand inventory in preparation to be picked for the order. If not, it is stored in the warehouse for future use.
9. **Pick product**—Order fulfillment is scheduled and sequenced to optimize order picking efficiency while maintaining delivery schedules.
10. **Prepare and ship order**—The order is loaded, transportation paperwork is created, and the freight is released to the carrier for delivery. At this point, the seller invoices the customer.
11. **Customer delivery and receipt verification**—Once the shipment is delivered to the customer location, an inspection is completed to verify that the correct product and quantity was delivered. This step concludes the traditional order cycle. Successful completion of the order cycle facilitates faster payment from the customer.
12. **Install product**—If needed, installation takes place at the customer location. The success of the installation has an impact on customer satisfaction and the speed of cash flow back to the seller.
13. **Invoice**—Satisfied with product and order cycle performance, the buyer initiates payment to the seller. The final payment flow works its way back to the seller.

The length and reliability of the OTC cycle affect both the buyer and seller. When the OTC cycle time average is long or the variability is high, customers are forced to carry