

WHAT IS A SUPPLY CHAIN?

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves. Within each organization, such as a manufacturer, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service.

Consider a customer walking into a Wal-Mart store to purchase detergent. The supply chain begins with the customer and his or her need for detergent. The next stage of this supply chain is the Wal-Mart retail store that the customer visits. Wal-Mart stocks its shelves using inventory that may have been supplied from a finished-goods warehouse or a distributor using trucks supplied by a third party. The distributor in turn is stocked by the manufacturer (say, Proctor & Gamble [P&G] in this case). The P&G manufacturing plant receives raw

2 THE OBJECTIVE OF A SUPPLY CHAIN

The objective of every supply chain should be to maximize the overall value generated. The value a supply chain generates is the difference between what the final product is worth to the customer and the costs the supply chain incurs in filling the customer's request. For most commercial supply chains, value will be strongly correlated with *supply chain profitability* (also known as *supply chain surplus*), the difference between the revenue generated from the customer and the overall cost across the supply chain. For example, a customer purchasing a wireless router from Best Buy pays \$60, which represents the revenue the supply chain receives. Best Buy and other stages of the supply chain incur costs to convey information, produce components, store them, transport them, transfer funds, and so on. The difference between the \$60 that the customer paid and the sum of all costs incurred by the supply chain to produce and distribute the router represents the supply chain profitability or surplus. Supply chain profitability or surplus is the total profit to be shared across all supply chain stages and intermediaries. The higher the supply chain profitability, the more successful is the supply chain. Supply chain success should be measured in terms of supply chain profitability and not in terms of the profits at an individual stage. (In subsequent chapters we see that a focus on profitability at individual stages may lead to a reduction in overall supply chain profits.)

Having defined the success of a supply chain in terms of supply chain profitability, the next logical step is to look for sources of revenue and cost. For any supply chain, there is only one source of revenue: the customer. At Wal-Mart, a customer purchasing detergent is the only one providing positive cash flow for the supply chain. All other cash flows are simply fund exchanges that occur within the supply chain, given that different stages have different owners. When Wal-Mart pays its supplier, it is taking a portion of the funds the customer provides and passing that money on to the supplier. All flows of information, product, or funds generate costs within the supply chain. Thus, the appropriate management of these flows is a key to supply chain success. Effective *supply chain management* involves the management of supply chain assets and product, information, and fund flows to maximize total supply chain profitability.

In this book we will have a strong focus on analyzing all supply chain decisions in terms of their impact on the supply chain surplus. These decisions and

their impact can vary for a wide variety of reasons. For instance, consider the difference in the supply chain structure for fast-moving consumer goods observed in the United States and India. The U.S. distributors play a much smaller role in this supply chain compared to their Indian counterparts. We argue that the difference in supply chain structure can be explained by the impact a distributor has on the supply chain surplus in the two countries.

Retailing in the United States is largely consolidated, with large chains buying consumer goods from most manufacturers. This consolidation gives retailers sufficient scale that the introduction of an intermediary such as a distributor does little to reduce costs and may actually increase costs because of an additional transaction. In contrast, India has millions of small retail outlets. The small size of Indian retail outlets limits the amount of inventory they can hold, thus requiring frequent replenishment—an order can be compared with the weekly grocery shopping for a family in the United States. The only way for a manufacturer to keep transportation costs low is to bring full truckloads of product close to the market and then distribute locally using “milk runs” with smaller vehicles. The presence of an intermediary who can receive a full truckload shipment, break bulk, and then make smaller deliveries to the retailers is crucial if transportation costs are to be kept low. Most Indian distributors are one-stop shops, stocking everything from cooking oil to soaps and detergents made by a variety of manufacturers. Besides the convenience provided by one-stop shopping, distributors in India are also able to reduce transportation costs for outbound delivery to the retailer by aggregating products across multiple manufacturers during the delivery runs. Distributors in India also handle collections, because their cost of collection is significantly lower than each manufacturer collecting from retailers on its own. Thus, the important role of distributors in India can be explained by the growth in supply chain surplus that results from their presence. The supply chain surplus argument implies that as retailing in India begins to consolidate, the role of distributors will diminish.

1.4 DECISION PHASES IN A SUPPLY CHAIN

Successful supply chain management requires many decisions relating to the flow of information, product, and funds. Each decision should be made to raise the supply chain surplus. These decisions fall into three categories or phases, depending on the frequency of each decision and the time frame during which a decision phase has an impact. As a result, each category of decisions must consider uncertainty over the decision horizon.

1. **Supply Chain Strategy or Design:** During this phase, given the marketing and pricing plans for a product, a company decides how to structure the supply chain over the next several years. It decides what the chain's configuration will be, how resources will be allocated, and what processes each stage will perform. Strategic decisions made by companies include whether to outsource or perform a supply chain function in-house, the location and capacities of production and warehousing facilities, the products to be manufactured or stored at various locations, the modes of transportation to be made available along different shipping legs, and the type of information system to be utilized. A firm must ensure that the supply chain configuration supports its strategic objectives and increases the supply chain surplus during this phase. Cisco's decisions regarding its choice of supply sources for components, contract manufacturers for manufacturing, and the location and capacity of its warehouses, are all supply chain design or strategic decisions. Supply chain design decisions are typically made for the long term (a matter of years) and are very expensive to alter on short notice. Consequently, when companies make these decisions, they must take into account uncertainty in anticipated market conditions over the next few years.

2. **Supply Chain Planning:** For decisions made during this phase, the time frame considered is a quarter to a year. Therefore, the supply chain's configuration determined in the strategic phase is fixed. This configuration establishes constraints within which planning must be done. The goal of planning is to maximize the supply chain surplus that can be generated over the planning horizon given the constraints established during the strategic or design phase. Companies start the planning phase with a forecast for the coming year (or a comparable time frame) of demand in different markets. Planning includes making decisions regarding which markets will be supplied from which locations, the subcontracting of manufacturing, the inventory policies to be followed, and the timing and size of marketing and price promotions. Dell's decisions regarding markets supplied by a production facility and target production quantities at each location are classified as planning decisions. Planning establishes parameters within which a supply chain will function over a specified period of time. In the planning phase, companies must include uncertainty in demand, exchange rates, and competition over this time horizon in their decisions. Given a shorter time frame and better forecasts than the design phase, companies in the planning phase try to incorporate any flexibility built into the supply chain in the design phase and exploit it to optimize performance. As a result of the planning phase, companies define a set of operating policies that govern short-term operations.

3. **Supply Chain Operation:** The time horizon here is weekly or daily, and during this phase companies make decisions regarding individual customer

orders. At the operational level, supply chain configuration is considered fixed, and planning policies are already defined. The goal of supply chain operations is to handle incoming customer orders in the best possible manner. During this phase, firms allocate inventory or production to individual orders, set a date that an order is to be filled, generate pick lists at a warehouse, allocate an order to a particular shipping mode and shipment, set delivery schedules of trucks, and place replenishment orders. Because operational decisions are being made in the short term (minutes, hours, or days), there is less uncertainty about demand information. Given the constraints established by the configuration and planning policies, the goal during the operation phase is to exploit the reduction of uncertainty and optimize performance.

The design, planning, and operation of a supply chain have a strong impact on overall profitability and success. It is fair to state that a large part of the success of firms like Wal-Mart and Dell can be attributed to their effective supply chain design, planning, and operation.

In later chapters, we develop concepts and present methodologies that can be used at each of the three decision phases described earlier. Most of our discussion addresses the supply chain design and planning phases.

KEY POINT Supply chain decision phases may be categorized as design, planning, or operational, depending on the time frame during which the decisions made apply.

1.5 PROCESS VIEWS OF A SUPPLY CHAIN

A supply chain is a sequence of processes and flows that take place within and between different stages and combine to fill a customer need for a product. There are two different ways to view the processes performed in a supply chain.

1. **Cycle View:** The processes in a supply chain are divided into a series of cycles, each performed at the interface between two successive stages of a supply chain.
2. **Push/Pull View:** The processes in a supply chain are divided into two categories depending on whether they are executed in response to a customer order or in anticipation of customer orders. *Pull* processes are initiated by a customer order, whereas *push* processes are initiated and performed in anticipation of customer orders.

CYCLE VIEW OF SUPPLY CHAIN PROCESSES

Given the five stages of a supply chain shown in Figure 1-2, all supply chain processes can be broken down into the following four process cycles, as shown in Figure 1-3:

- Customer order cycle
- Replenishment cycle
- Manufacturing cycle
- Procurement cycle

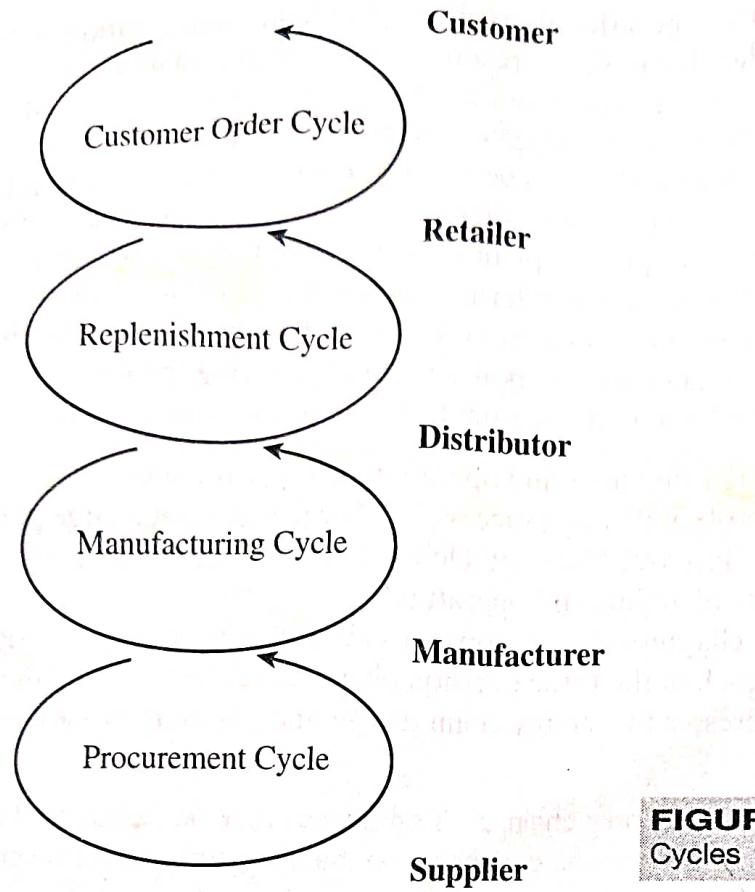


FIGURE 1-3 Supply Chain Process Cycles

Each cycle occurs at the interface between two successive stages of the supply chain. The five stages thus result in four supply chain process cycles. Not every supply chain will have all four cycles clearly separated. For example, a grocery supply chain in which a retailer stocks finished-goods inventories and places replenishment orders with a distributor is likely to have all four cycles separated. Dell, in contrast, sells directly to customers, thus bypassing the retailer and distributor.

Each cycle consists of six subprocesses as shown in Figure 1-4. Each cycle starts with the supplier marketing the product to customers. A buyer then places an order that is received by the supplier. The supplier supplies the

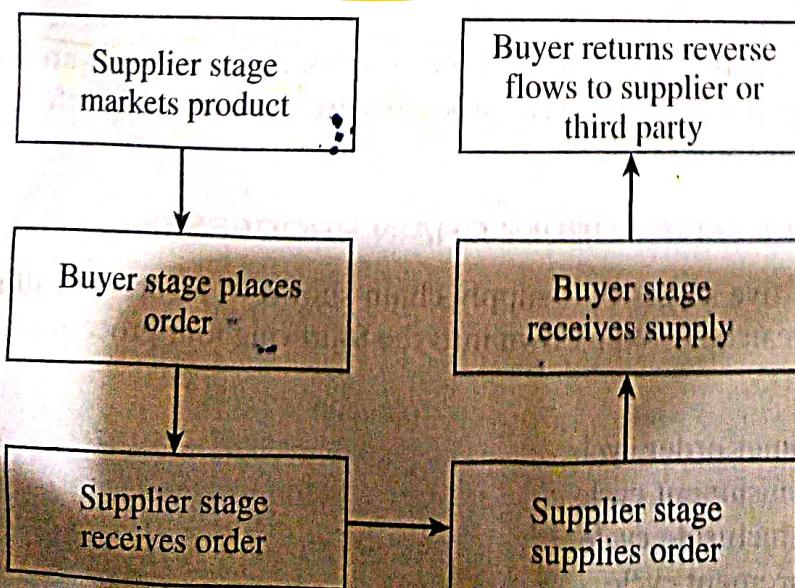


FIGURE 1-4 Subprocesses in Each Supply Chain Process Cycle

order, which is received by the buyer. The buyer may return some of the product or other recycled material to the supplier or a third party. The cycle of activities then begins all over again.

Depending on the transaction in question, the subprocesses in Figure 1-4 can be applied to the appropriate cycle. When customers shop online at Amazon, they are part of the customer order cycle—with the customer as the buyer and Amazon as the supplier. In contrast, when Amazon orders books from a distributor to replenish its inventory, it is part of the replenishment cycle—with Amazon as the buyer and the distributor as the supplier.

Within each cycle, the goal of the buyer is to ensure product availability and to achieve economies of scale in ordering. The supplier attempts to forecast customer orders and reduce the cost of receiving the order. The supplier then works to fill the order on time and improve efficiency and accuracy of the order fulfillment process. The buyer then works to reduce the cost of the receiving process. Reverse flows are managed to reduce cost and meet environmental objectives.

Even though each cycle has the same basic subprocesses, there are a few important differences between cycles. In the customer order cycle, demand is external to the supply chain and thus uncertain. In all other cycles, order placement is uncertain but can be projected based on policies followed by the particular supply chain stage. For example, in the procurement cycle, a tire supplier to an automotive manufacturer can predict tire demand precisely once the production schedule at the manufacturer is known. The second difference across cycles relates to the scale of an order. Whereas a customer buys a single car, the dealer orders multiple cars at a time from the manufacturer, and the manufacturer, in turn, orders an even larger quantity of tires from the supplier. As we move from the customer to the supplier, the number of individual orders declines and the size of each order increases. Thus, sharing of information and operating policies across supply chain stages becomes more important as we move farther from the end customer.

A cycle view of the supply chain is very useful when considering operational decisions because it clearly specifies the roles of each member of the supply chain. The detailed process description of a supply chain in the cycle view forces a supply chain designer to consider the infrastructure required to support these processes. The cycle view is useful, for example, when setting up information systems to support supply chain operations.

KEY POINT A cycle view of the supply chain clearly defines the processes involved and the owners of each process. This view is very useful when considering operational decisions because it specifies the roles and responsibilities of each member of the supply chain and the desired outcome for each process.

PUSH/PULL VIEW OF SUPPLY CHAIN PROCESSES

All processes in a supply chain fall into one of two categories depending on the timing of their execution relative to end customer demand. With pull processes, execution is initiated in response to a customer order. With push

CHAPTER 2

SUPPLY CHAIN PERFORMANCE: ACHIEVING STRATEGIC FIT AND SCOPE

Learning Objectives

After reading this chapter, you will be able to:

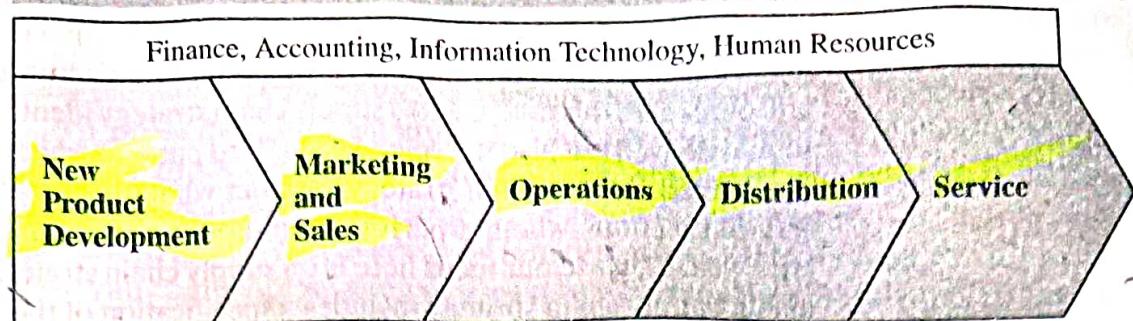
1. Explain why achieving strategic fit is critical to a company's overall success.
2. Describe how a company achieves strategic fit between its supply chain strategy and its competitive strategy.
3. Discuss the importance of expanding the scope of strategic fit across the supply chain.

In Chapter 1, we discuss what a supply chain is and the importance of supply chain design, planning, and operation to a firm's success. In this chapter, we define supply chain strategy and explain how creating a strategic fit between a company's competitive strategy and its supply chain strategy affects performance. We also discuss the importance of expanding the scope of strategic fit from one operation within a company to all stages of the supply chain.

2.1 COMPETITIVE AND SUPPLY CHAIN STRATEGIES

A company's *competitive strategy* defines, relative to its competitors, the set of customer needs that it seeks to satisfy through its products and services. For example, Wal-Mart aims to provide high availability of a variety of products of reasonable quality at low prices. Most products sold at Wal-Mart are commonplace (*everything from home appliances to clothing*) and can be purchased elsewhere. What Wal-Mart provides is a low price and product availability. McMaster-Carr sells maintenance, repair, and operations (MRO) products. It offers more than 400,000 different products through both a catalog and a Web site. Its competitive strategy is built around providing the customer with convenience, availability, and responsiveness. With this focus on responsiveness, McMaster does not compete based on low price. Clearly, the competitive strategy at Wal-Mart is different from that at McMaster.

We can also contrast Dell, with its build-to-order model, with a firm like Gateway selling eMachines PCs through retailers. Dell has stressed customization and variety at a reasonable cost, with customers having to wait approximately one week to get their product. In contrast, a customer can walk into a computer retailer, be helped by a salesperson, and leave the same day.

FIGURE 2-1 The Value Chain in a Company

with an eMachines computer. The amount of variety and customization available at the retailer, however, is limited. In each case, the competitive strategy is defined based on how the customer prioritizes product cost, delivery time, variety, and quality. A McMaster-Carr customer places greater emphasis on product variety and response time than on cost. A Wal-Mart customer, in contrast, places greater emphasis on cost. A Dell customer, purchasing online, places great emphasis on product variety and customization. A customer purchasing an eMachines PC at a retailer is most concerned with price, fast response time, and help in product selection. Thus, a firm's competitive strategy will be defined based on its customers' priorities. Competitive strategy targets one or more customer segments and aims to provide products and services that satisfy these customers' needs.

To see the relationship between competitive and supply chain strategies, we start with the value chain for a typical organization, as shown in Figure 2-1.

The value chain begins with new product development, which creates specifications for the product. Marketing and sales generate demand by publicizing the customer priorities that the products and services will satisfy. Marketing also brings customer input back to new product development. Using new product specifications, operations transforms inputs to outputs to create the product. Distribution either takes the product to the customer or brings the customer to the product. Service responds to customer requests during or after the sale. These are core processes or functions that must be performed for a successful sale. Finance, accounting, information technology, and human resources support and facilitate the functioning of the value chain.

To execute a company's competitive strategy, all these functions play a role, and each must develop its own strategy. Here, strategy refers to what each process or function will try to do particularly well.

A *product development* strategy specifies the portfolio of new products that a company will try to develop. It also dictates whether the development effort will be made internally or outsourced. A *marketing and sales* strategy specifies how the market will be segmented and how the product will be positioned, priced, and promoted. A *supply chain strategy* determines the nature of procurement of raw materials, transportation of materials to and from the company, manufacture of the product or operation to provide the service, and distribution of the product to the customer, along with any follow-up service and a specification of whether these processes will be performed in-house or outsourced. Given that firms are

a company can have a highly flexible and responsive supply chain that is very good at producing a large variety of products. In this second case, costs will be higher than in an efficient supply chain. Both supply chain strategies are viable by themselves, but do not necessarily fit with Dell's competitive strategy. A supply chain strategy that emphasizes flexibility and responsiveness has a better strategic fit with Dell's competitive strategy of providing a large variety of customizable products.

This notion of fit also extends to Dell's other functional strategies. For instance, its new product development strategy should emphasize designing products that are easily customizable, which may include designing common platforms across several products and the use of common components. Dell products use common components and are designed to be assembled quickly. This feature allows Dell to assemble customized PCs quickly in response to a customer order. The design of new products at Dell supports the supply chain's ability to assemble customized PCs in response to customer orders. This capability, in turn, supports Dell's strategic goal of offering customization to its customers. Dell has clearly achieved strong strategic fit among its different functional strategies and its competitive strategy. The notion of fit also extends to other stages in the Dell supply chain. Given that Dell provides a high degree of customization while operating with low levels of inventory, it is crucial that its suppliers and carriers be responsive. For example, the ability of carriers to merge a PC from Dell with a monitor from Sony allows Dell not to carry any Sony monitors in inventory. Dell has tried to achieve this alignment of capabilities across the supply chain.

HOW IS STRATEGIC FIT ACHIEVED?

What does a company need to do to achieve that all-important strategic fit between the supply chain and competitive strategies? A competitive strategy will specify, either explicitly or implicitly, one or more customer segments that a company hopes to satisfy. To achieve strategic fit, a company must ensure that its supply chain capabilities support its ability to satisfy the targeted customer segments.

There are three basic steps to achieving this strategic fit, which we outline here and then discuss in more detail:

1. Understanding the Customer and Supply Chain Uncertainty: First, a company must understand the customer needs for each targeted segment and the uncertainty the supply chain faces in satisfying these needs. These needs help the company define the desired cost and service requirements. The supply chain uncertainty helps the company identify the extent of the unpredictability of demand, disruption, and delay that the supply chain must be prepared for.

2. Understanding the Supply Chain Capabilities: There are many types of supply chains, each of which is designed to perform different tasks well. A company must understand what its supply chain is designed to do well.

3. Achieving Strategic Fit: If a mismatch exists between what the supply chain does particularly well and the desired customer needs, the company will either

need to restructure the supply chain to support the competitive strategy or alter its competitive strategy.

Step 1: Understanding the Customer and Supply Chain Uncertainty

To understand the customer, a company must identify the needs of the customer segment being served. Let us compare Seven-Eleven Japan and a discounter such as Sam's Club (a part of Wal-Mart). When customers go to Seven-Eleven to purchase detergent, they go there for the convenience of a nearby store and are not necessarily looking for the lowest price. In contrast, low price is very important to a Sam's Club customer. This customer may be willing to tolerate less variety and even purchase very large package sizes as long as the price is low. Even though customers purchase detergent at both places, the demand varies along certain attributes. In the case of Seven-Eleven, customers are in a hurry and want convenience. In the case of Sam's Club, they want a low price and are willing to spend time getting it. In general, customer demand from different segments varies along several attributes as follows.

- **The Quantity of the Product Needed in Each Lot:** An emergency order for material needed to repair a production line is likely to be small. An order for material to construct a new production line is likely to be large.
- **The Response Time that Customers are Willing to Tolerate:** The tolerable response time for the emergency order is likely to be short, whereas the allowable response time for the construction order is apt to be long.
- **The Variety of Products Needed:** A customer may place a high premium on the availability of all parts of an emergency repair order from a single supplier. This may not be the case for the construction order.
- **The Service Level Required:** A customer placing an emergency order expects a high level of product availability. This customer may go elsewhere if all parts of the order are not immediately available. This is not apt to happen in the case of the construction order, for which a long lead time is likely.
- **The Price of the Product:** The customer placing the emergency order is apt to be much less sensitive to price than the customer placing the construction order.
- **The Desired Rate of Innovation in the Product:** Customers at a high-end department store expect a lot of innovation and new designs in the store's apparel. Customers at Wal-Mart may be less sensitive to new product innovation.

Each customer in a particular segment will tend to have similar needs, whereas customers in a different segment can have very different needs.

Although we have described the many attributes along which customer demand varies, our goal is to identify one key measure for combining all of these attributes. This single measure then helps define what the supply chain should do particularly well.

Implied Demand Uncertainty. At first glance, it may appear that each of the customer need categories should be viewed differently, but in a very

- *Days sales outstanding* measures the average time between when a sale is made and when the cash is collected.
- *Incremental fixed cost per order* measures the incremental costs that are independent of the size of the order. These include changeover costs at a manufacturing plant or order processing or transportation costs that are incurred independent of shipment size at a mail-order firm.
- *Incremental variable cost per unit* measures the incremental costs that vary with the size of the order. These include picking costs at a mail-order firm or variable production costs at a manufacturing plant.
- *Average sale price* measures the average price at which a supply chain activity was performed in a given period. The average should be obtained by weighting the price with the quantity sold at that price.
- *Average order size* measures the average quantity per order. The average sale price, order size, incremental fixed cost per order, and incremental variable cost per unit help estimate the contribution from performing the supply chain activity.
- *Range of sale price* measures the maximum and the minimum of sale price per unit over a specified time horizon.
- *Range of periodic sales* measures the maximum and the minimum of the quantity sold per period (day/week/month) during a specified time horizon. The goal is to understand any correlation between sales and price and any potential opportunity to shift sales by changing price over time.

Overall Trade-Off: Increase Firm Profits

All pricing decisions should be made with the objective of increasing firm profits. This requires an understanding of the cost structure of performing a supply chain activity and the value this activity brings to the supply chain. Strategies such as everyday low pricing may foster stable demand that allows for efficiency in the supply chain. Other pricing strategies may lower supply chain costs, defend market share, or even steal market share. Differential pricing may be used to attract customers with varying needs, as long as this strategy helps either increase revenues or shrink costs, preferably both.

In the next section, we discuss the main obstacles companies face when striving to achieve strategic fit.

3.9 OBSTACLES TO ACHIEVING STRATEGIC FIT

The key to achieving strategic fit is a company's ability to find a balance between responsiveness and efficiency that best matches the needs of its target customer. In deciding where this balance should be located on the responsiveness spectrum, companies face many obstacles. In this section we discuss some of the obstacles and also provide a feel for how the supply chain environment has changed over the years. On one hand, these obstacles have made it much more difficult for companies to create the ideal balance. On the other hand, they have afforded companies increased opportunities for improving supply chain management. Managers need a solid understanding of the impact of

these obstacles because they are critical to a company's ability to reap the maximum profitability from its supply chain.

INCREASING VARIETY OF PRODUCTS

Product proliferation is rampant today. With customers demanding ever more customized products, manufacturers have responded with mass customization and even segment-of-one (companies view each customer as an independent market segment) views of the market. Products that were formerly quite generic are now custom-made for a specific consumer. For example, the number of running shoe styles sold in the United States went from five in the early 1970s to almost 300 by the late 1990s. The increase in product variety complicates the supply chain by making forecasting much more difficult. Increased variety tends to raise uncertainty, and increased uncertainty hurts both efficiency and responsiveness within the supply chain.

DECREASING PRODUCT LIFE CYCLES

In addition to the increasing variety of product types, the life cycle of products has been shrinking. Today there are products whose life cycles can be measured in months, compared to the old standard of years. These are not just niche products, either. PCs now have a life cycle of several months, and even some automobile manufacturers have lowered their product life cycles from five plus years to about three years. This decrease in product life cycles makes the job of achieving strategic fit more difficult, as the supply chain must constantly adapt to manufacture and deliver new products, in addition to coping with these products' demand uncertainty. Shorter life cycles increase uncertainty while reducing the window of opportunity within which the supply chain can achieve fit. Increased uncertainty combined with a smaller window of opportunity has put additional pressure on supply chains to coordinate and create a good match between supply and demand.

INCREASINGLY DEMANDING CUSTOMERS

Customers are constantly demanding improvements in delivery lead times, cost, and product performance. If they do not receive these improvements, they move on to new suppliers. Many companies had periodic, standard price increases—not due to a rise in demand or any other factor, but simply because raising prices was the way business was done. Now, one repeatedly sees companies that cannot force through *any* price increases without losing market share. Today's customers are demanding faster fulfillment, better quality, and better-performing products for the same price they paid years ago. This tremendous growth in customer *demands* (not necessarily *demand*) means that the supply chain must provide more just to maintain its business.

FRAGMENTATION OF SUPPLY CHAIN OWNERSHIP

Over the past several decades, most firms have become less vertically integrated. As companies have shed noncore functions, they have been able to take advantage of supplier and customer competencies that they themselves

did not have. This new ownership structure, however, has also made managing the supply chain more difficult. With the chain broken into many owners, each with its own policies and interests, the chain is more difficult to coordinate. Potentially, this problem could cause each stage of a supply chain to work only toward its own objectives rather than the whole chain's, resulting in the reduction of overall supply chain profitability.

GLOBALIZATION

Supply chains today are more likely than ever to be global. Establishing a global supply chain creates many benefits, such as the ability to source from a global base of suppliers who may offer better or cheaper goods than were available in a company's home nation. Globalization, however, also adds stress to the chain, because facilities within the chain are farther apart, making coordination much more difficult.

Globalization has also increased competition, as once-protected national players must compete with companies from around the world. In the past, with fewer companies satisfying customers' needs, customers were willing to tolerate longer response times. However, in most industries there are now many more firms aggressively pursuing their competitors' business. This competitive situation makes supply chain performance a key to maintaining and growing sales while also putting more strain on supply chains and thus forcing them to choose their trade-offs even more precisely.

DIFFICULTY EXECUTING NEW STRATEGIES

Creating a successful supply chain strategy is not easy. Once a good strategy is formulated, however, the execution of the strategy can be even more difficult. For instance, Toyota's production system, which is a supply chain strategy, has been widely known and understood. Yet this strategy has been a sustained competitive advantage for Toyota for more than two decades. Does Toyota have a brilliant strategy that no one else can figure out? Their strategy is brilliant, but many others have figured it out. The difficulty other firms have had is in executing that strategy. Many highly talented employees at all levels of the organization are necessary to make a supply chain strategy successful. Although we deal mostly with the formulation of strategy in this book, one should keep in mind that skillful execution of a strategy can be as important as the strategy itself.

All of the obstacles discussed earlier are making it more difficult for companies to achieve strategic fit in the supply chain. These obstacles also represent a tremendous opportunity in terms of untapped improvement within the supply chain. The increasing impact of these obstacles has led to supply chain management becoming a major factor in the success or failure of firms.

SIMULTANEOUS PURSUIT OF RESPONSIVENESS AND EFFICIENCY

The objectives of responsiveness and efficiency in supply chains can be pursued simultaneously. Between supply chains that are equally responsive, the more efficient is likely to be more successful. Providing a higher degree of

CHAPTER 3

SUPPLY CHAIN DRIVERS AND METRICS

Learning Objectives

After reading this chapter, you will be able to:

1. Identify the major drivers of supply chain performance.
2. Discuss the role each driver plays in creating strategic fit between the supply chain strategy and the competitive strategy.
3. Define the key metrics that track the performance of the supply chain in terms of each driver.
4. Describe the major obstacles that must be overcome to manage a supply chain successfully.

In this chapter, we introduce the three logistical drivers—facilities, inventory, and transportation—and the three cross-functional drivers—information, sourcing, and pricing—that determine the performance of any supply chain. We discuss how these drivers are used in the design, planning, and operation of the supply chain. We define several metrics that can be used to gauge the performance of each driver. We also introduce many of the obstacles faced by supply chain managers.

3.1 DRIVERS OF SUPPLY CHAIN PERFORMANCE

The strategic fit discussed in Chapter 2 requires that a company's supply chain achieve the balance between responsiveness and efficiency that best meets the needs of the company's competitive strategy. To understand how a company can improve supply chain performance in terms of responsiveness and efficiency, we must examine the logistical and cross-functional drivers of supply chain performance: facilities, inventory, transportation, information, sourcing, and pricing. These drivers interact with each other to determine the supply chain's performance in terms of responsiveness and efficiency. As a result, the structure of these drivers determines if and how strategic fit is achieved across the supply chain.

First we define each driver and discuss its impact on the performance of the supply chain.

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1. **Facilities** are the actual physical locations in the supply chain network where product is stored, assembled, or fabricated. The two major types of

facilities are production sites and storage sites. Decisions regarding the role, location, capacity, and flexibility of facilities have a significant impact on the supply chain's performance. For instance, an auto-parts distributor striving for responsiveness could have many warehousing facilities located close to customers even though this practice reduces efficiency. Alternatively, a high-efficiency distributor would have fewer warehouses to increase efficiency despite the fact that this practice will reduce responsiveness.

2. **Inventory** encompasses all raw materials, work in process, and finished goods within a supply chain. Changing inventory policies can dramatically alter the supply chain's efficiency and responsiveness. For example, a clothing retailer can make itself more responsive by stocking large amounts of inventory and satisfying customer demand from stock. A large inventory, however, increases the retailer's cost, thereby making it less efficient. Reducing inventory makes the retailer more efficient but hurts its responsiveness.

3. **Transportation** entails moving inventory from point to point in the supply chain. Transportation can take the form of many combinations of modes and routes, each with its own performance characteristics. Transportation choices have a large impact on supply chain responsiveness and efficiency. For example, a mail-order catalog company can use a faster mode of transportation such as FedEx to ship products, thus making its supply chain more responsive, but also less efficient given the high costs associated with using FedEx. Or the company can use slower but cheaper ground transportation to ship the product, making the supply chain efficient but limiting its responsiveness.

4. **Information** consists of data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain. Information is potentially the biggest driver of performance in the supply chain because it directly affects each of the other drivers. Information presents management with the opportunity to make supply chains more responsive and more efficient. For example, with information on customer demand patterns, a pharmaceutical company can produce and stock drugs in anticipation of customer demand, which makes the supply chain very responsive because customers will find the drugs they need when they need them. This demand information can also make the supply chain more efficient because the pharmaceutical firm is better able to forecast demand and produce only the required amount. Information can also make this supply chain more efficient by providing managers with shipping options, for instance, that allow them to choose the lowest-cost alternative while still meeting the necessary service requirements.

5. **Sourcing** is the choice of who will perform a particular supply chain activity such as production, storage, transportation, or the management of information. At the strategic level, these decisions determine what functions a firm performs and what functions the firm outsources. Sourcing decisions affect both the responsiveness and efficiency of a supply chain. After Motorola outsourced much of its production to contract manufacturers in China, it saw its efficiency improve but its responsiveness suffer because of the long distances. To make up for the drop in responsiveness, Motorola started flying in some of

its cell phones from China even though this choice increased transportation cost. Flextronics, an electronics contract manufacturer, is hoping to offer both responsive and efficient sourcing options to its customers. It is trying to make its production facilities in the United States very responsive while keeping its facilities in low-cost countries efficient. Flextronics hopes to become an effective source for all customers using this combination of facilities.

6. **Pricing** determines how much a firm will charge for goods and services that it makes available in the supply chain. Pricing affects the behavior of the buyer of the good or service, thus affecting supply chain performance. For example, if a transportation company varies its charges based on the lead time provided by the customers, it is very likely that customers who value efficiency will order early and customers who value responsiveness will be willing to wait and order just before they need a product transported. Early orders are less likely if prices do not vary with lead time.

Our definition of these drivers attempts to delineate logistics and supply chain management. Supply chain management includes the use of logistical and cross-functional drivers to increase the supply chain surplus. Cross-functional drivers have become increasingly important in raising the supply chain surplus in recent years. While logistics remains a major part, supply chain management is increasingly becoming focused on the three cross-functional drivers.

It is important to realize that these drivers do not act independently but interact with each other to determine the overall supply chain performance. Good supply chain design and operation recognizes this interaction and makes the appropriate trade-offs to deliver the desired level of responsiveness. Consider, for example, the furniture industry in the United States. Low-cost furniture sourced from Asia is available at many discount retailers. The primary goal of this supply chain is to deliver a low price and acceptable quality. Variety is typically low and retailers such as Wal-Mart keep a high stock inventory of finished goods. The low variety and stable replenish orders allow furniture manufacturers in Asia to focus on efficiency. Customers can access the available inventory, low-cost modes of transportation from Asia are used. In this instance, relatively low-cost inventory at the retailer allows the supply chain to become efficient by lowering transportation and production costs. In contrast, some U.S. furniture makers have chosen to focus on providing variety. Given the high variety and high prices, keeping inventory of all variants at a retailer would be very expensive. In this case the supply chain has been designed so the retailer carries very little inventory. Customers place their orders with the retailer by seeing one variant of the furniture and selecting among the various options. The supply chain is made responsive by using information technology to convey order information effectively, structuring very flexible manufacturing facilities to be able to produce in small lots, and using responsive transportation to deliver the furniture to the customer. In this instance, responsive facilities, transportation, and information are used to lower inventory costs. As the following chapter will illustrate, the key to achieving strategic fit across the supply chain is to structure the supply chain drivers appropriately to provide the desired level of responsiveness.

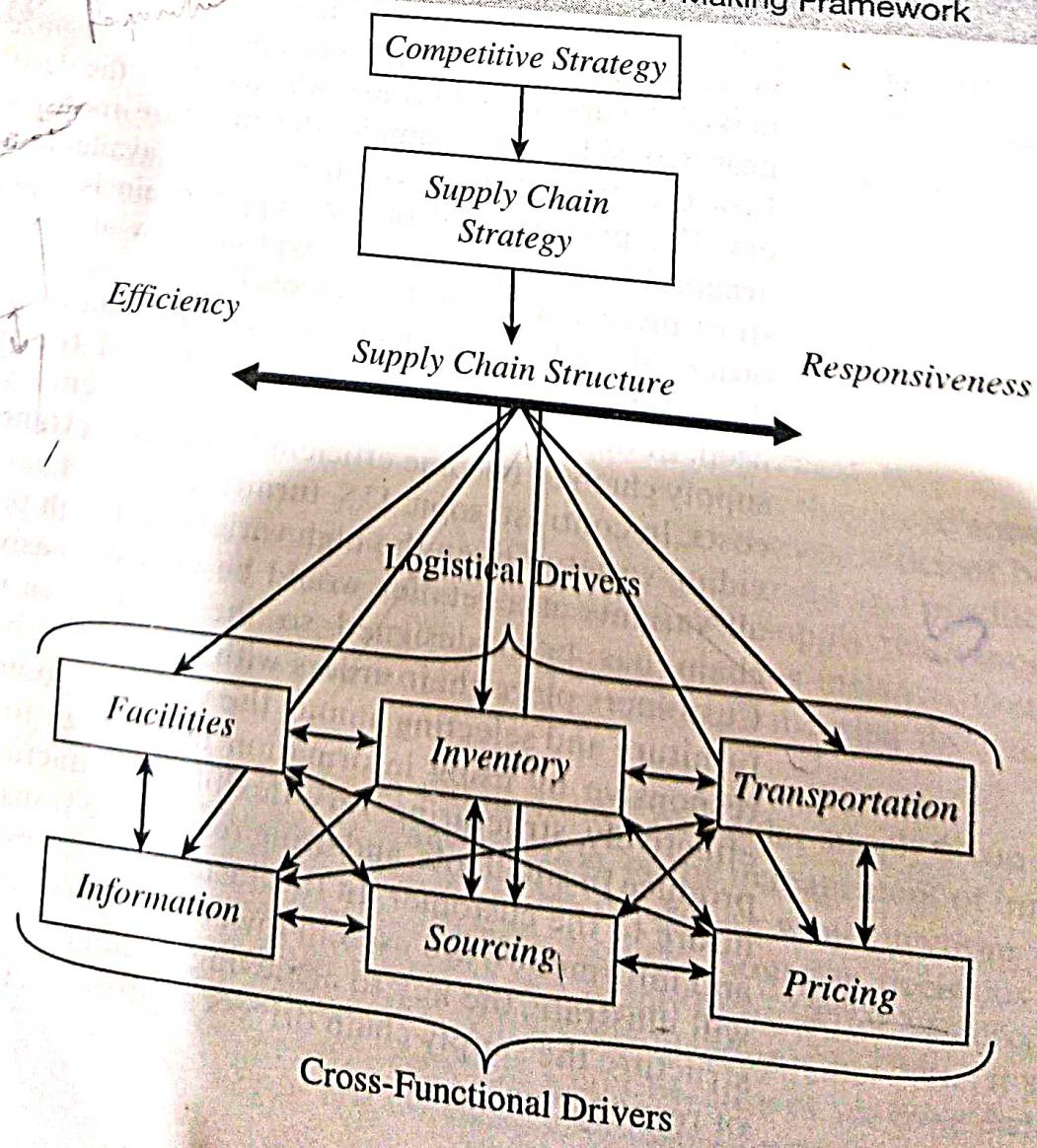
Before we discuss each of the six drivers in detail, we put these drivers into a framework that helps to clarify the role of each driver in improving supply chain performance.

3.2 FRAMEWORK FOR STRUCTURING DRIVERS

Recall from Chapter 2 that the goal of a supply chain strategy is to strike the balance between responsiveness and efficiency that fits with the competitive strategy. To reach this goal, a company must structure the right combination of the three logistical and three cross-functional drivers discussed earlier. For each of the individual drivers, supply chain managers must make a trade-off between efficiency and responsiveness based on interaction with the other drivers. The combined impact of these drivers then determines the responsiveness and the profits of the entire supply chain.

We provide a visual framework for supply chain decision making in Figure 3-1. Most companies begin with a competitive strategy and then decide what their supply chain strategy ought to be. The supply chain strategy

FIGURE 3-1 Supply Chain Decision-Making Framework



determines how the supply chain should perform with respect to efficiency and responsiveness. The supply chain must then use the three logistical and three cross-functional drivers to reach the performance level the supply chain strategy dictates and maximize the supply chain profits. Although this framework is generally viewed from the top down, in many instances, a study of the six drivers may indicate the need to change the supply chain and potentially even the competitive strategy.

Consider this framework using Wal-Mart as an example. Wal-Mart's competitive strategy is to be a reliable, low-cost retailer for a wide variety of mass-consumption goods. This strategy dictates that the ideal supply chain will emphasize efficiency but also maintain an adequate level of responsiveness. Wal-Mart uses the three logistical and three cross-functional drivers effectively to achieve this type of supply chain performance. With the inventory driver, Wal-Mart maintains an efficient supply chain by keeping low levels of inventory. For instance, Wal-Mart pioneered cross-docking, a system in which inventory is not stocked in a warehouse but rather is shipped to stores from the manufacturer. These shipments make only brief stops at distribution centers (DCs), where they are transferred to trucks that make deliveries to stores. This significantly lowers inventory because products are stocked only at stores, not at both stores and warehouses. With respect to inventory, Wal-Mart favors efficiency over responsiveness. On the transportation front, on its own, Wal-Mart runs its own fleet, to keep responsiveness high. This increases transportation cost, but the benefits in terms of reduced inventory and improved product availability justify this cost in Wal-Mart's case. In the case of facilities, Wal-Mart uses centrally located DCs within its network of stores to decrease the number of facilities and increase efficiency at each DC. Wal-Mart builds retail stores only where the demand is sufficient to justify having several of them supported by a DC, thereby increasing efficiency of its transportation assets. To utilize information in the supply chain, Wal-Mart has invested significantly more than its competitors in information technology. As a result, Wal-Mart is a leader in its use of the information driver to improve responsiveness and decrease inventory investment. Wal-Mart feeds demand information across the supply chain to suppliers who manufacture only what is being demanded. The supply chain's ability to share demand information has required large investments, but the result is an improved supply chain in terms of both responsiveness and efficiency. With regard to the sourcing driver, Wal-Mart identifies efficient sources for each product it sells. Wal-Mart feeds them large orders, allowing them to be efficient by exploiting economies of scale. Finally, for the pricing driver, Wal-Mart practices "every day low pricing" (EDLP) for its products. This ensures that customer demand stays steady and does not fluctuate with price variations. The entire supply chain then focuses on meeting this demand in an efficient manner. Wal-Mart uses all the supply chain drivers to achieve the right balance between responsiveness and efficiency so that its competitive strategy and supply chain strategy are in harmony.

We devote the next six sections to a detailed discussion of each of the three logistical and three cross-functional drivers and their roles in the supply chain.