CHAPTER ONE

Understanding the Supply Chain

1.1 What Is a Supply Chain?

1.2 Decision Phases in a Supply Chain 1.3 Process View of a Supply Chain

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Learning Objectives

After reading this chapter, you will be able to:

1. Describe the cycle and push/pull views of a supply chain.
2. Classify the supply chain macro processes in a firm.
3. Identify the three key supply chain decision phases and explain the significance of each one.
4. Discuss the goal of a supply chain and explain the impact of supply chain decisions on the success of a firm.

In this chapter, we provide a conceptual understanding of what a supply chain is and the various issues that need to be considered when designing, planning, or operating a supply chain. We discuss the significance of supply chain issues to the success of a firm. We also provide several examples from different industries to emphasize the variety of supply chain issues that companies need to consider at the strategic, planning, and operational levels.

1.1 WHAT IS A SUPPLY CHAIN?

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and 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 their 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 that Wal-Mart manages or from a distributor using trucks supplied by a third party. The distributor in turn is stocked by the manufacturer (say Procter & Gamble [P &G] in this case). The P &G manufacturing plant receives raw material from a variety of suppliers who may themselves have been supplied by lower tier suppliers. For example, packaging material may come from Tenneco packaging while Tenneco receives raw materials to manufacture the packaging from other suppliers. This supply chain is illustrated in Figure 1.1.

A supply chain is dynamic and involves the constant flow of information, product, and funds between different stages. In our example, Wal-Mart provides the product, as well as pricing and availability information, to the customer. The customer transfers funds to Wal-Mart. Wal-Mart conveys point-of-sales data as well as replenishment orders to the warehouse or distributor, who transfers the replenishment order via trucks back to the store. Wal-Mart transfers funds to the distributor after the replenishment. The distributor also provides pricing information and sends delivery schedules to Wal-Mart. Similar information, material, and fund flows take place across the entire supply chain.
In another example, when a customer purchases online from Dell Computer, the supply chain includes, among others, the customer, Dell's Web site that takes the customer's order, the Dell assembly plant, and all of Dell's suppliers and their suppliers. The Web site provides the customer with information regarding pricing, product variety, and product availability. Having made a product choice, the customer enters the order information and pays for the product. The customer may later return to the Web site to check the status of the order. Stages further up the supply chain use customer order information to fill the order. That process involves an additional flow of information, product, and funds between various stages of the supply chain.

These examples illustrate that the customer is an integral part of the supply chain. The primary purpose for the existence of any supply chain is to satisfy customer needs, in the process generating profits for itself. Supply chain activities begin with a customer order and end when a satisfied customer has paid for his or her purchase. The term supply chain conjures up images of product or supply moving from suppliers to manufacturers to distributors to retailers to customers along a chain. It is important to visualize information, funds, and product flows along both directions of this chain. The term supply chain may also imply that only one player is involved at each stage. In reality, a manufacturer may receive material from several suppliers and then supply several distributors. Thus, most supply chains are actually networks. It may be more accurate to use the term supply network or supply web to describe the structure of most supply chains, as shown in Figure 1.2.

A typical supply chain may involve a variety of stages. These supply chain stages include:

- Customers
- Retailers
- Wholesalers/Distributors
- Manufacturers
- Component/Raw material suppliers
Each stage in Figure 1.2 need not be present in a supply chain. The appropriate design of the supply chain will depend on both the customer's needs and the roles of the stages involved. In some cases, such as Dell, a manufacturer may fill customer orders directly. Dell builds-to-order; that is, a customer order initiates manufacturing at Dell. Dell does not have a retailer, wholesaler, or distributor in its supply chain. In other cases, such as the mail order company L. L. Bean, manufacturers do not respond to customer orders directly. In this case, L. L. Bean maintains an inventory of product from which they fill customer orders. Compared to the Dell supply chain, the L. L. Bean supply chain contains an extra stage (the retailer, L. L. Bean itself) between the customer and the manufacturer. In the case of other retail stores, the supply chain may also contain a wholesaler or distributor between the store and the manufacturer.

The Objective of a Supply Chain

The objective of every supply chain is 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 effort the supply chain expends in filling the customer's request. For most commercial supply chains, value will be strongly correlated with supply chain profitability, the difference between the revenue generated from the customer and the overall cost across the supply chain. For example, a customer purchasing a computer from Dell pays $2,000, which represents the revenue the supply chain receives. Dell 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 $2,000 that the customer paid and the sum of all costs incurred by the supply chain to produce and distribute the computer represents the supply chain profitability. Supply chain profitability is the total profit to be shared across all supply chain stages. The higher the supply chain profitability, the more successful 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. Supply chain management involves the management of flows between and among stages in a supply chain to maximize total supply chain profitability.

In the next section, we categorize supply chain decision phases based on the frequency with which they are made and the time frame they take into account.

1.2 DECISION PHASES IN A SUPPLY CHAIN

Successful supply chain management requires many decisions relating to the flow of information, product, and funds. These decisions fall into three categories or phases, depending on the frequency of each decision and the time frame over which a decision phase has an impact.
1. **Supply chain strategy or design:** During this phase, 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 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 during this phase. Dell’s decisions regarding the location and capacity of its manufacturing facilities, warehouses, and supply sources 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. Companies start the planning phase with a forecast for the coming year (or a comparable time frame) of demand in different markets. Planning includes 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 promotions. Dell’s decisions regarding markets a given production facility will supply and target production quantities at different locations 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 horizon 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. Continuing with our example, consider Dell Computer. In the early 1990s, Dell management began to focus on improving the design, planning, and operation of the supply chain, with the result of significantly improved performance. Both profitability and the stock price have soared and Dell stock has had outstanding returns over this period.

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 over which the decisions made in a given phase apply.

### 1.3 PROCESS VIEW 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

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.

A cycle view of the supply chain is very useful when considering operational decisions because it clearly specifies the roles and responsibilities 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, as process ownership and objectives are clearly defined. We now describe the various supply chain cycles in greater detail.

### Customer Order Cycle

The customer order cycle occurs at the customer/retailer interface and includes all processes directly involved in receiving and filling the customer’s order. Typically, the customer initiates this cycle at a retailer site and the cycle primarily involves filling customer demand. The retailer’s interaction with the customer starts when the customer arrives or contact is initiated and ends when the customer receives the order. The processes involved in the customer order cycle are shown in Figure 1.4 and include:

- Customer arrival
- Customer order entry
- Customer order fulfillment
- Customer order receiving
**Customer Arrival**  The term customer arrival refers to the customer's arrival at the location where he or she has access to his or her choices and makes a decision regarding a purchase. The starting point for any supply chain is the arrival of a customer. Customer arrival can occur when

- The customer walks into a supermarket to make a purchase
- The customer calls a mail order telemarketing center
- The customer uses the Web or an electronic link to a mail order firm

From the supply chain perspective, the key flow in this process is the customer's arrival. The goal is to facilitate the contact between the customer and the appropriate product so that the customer's arrival turns into a customer order. At a supermarket, facilitating a customer order may involve managing customer flows and product displays. At a telemarketing center, it may mean ensuring that customers do not have to wait on hold for too long. It may also mean having systems in place so that sales representatives can answer customer queries in a way that turns calls into orders. At a Web site, a key system may be search capabilities with tools such as personalization that allow customers to quickly locate and view products that may interest them. The objective of the customer arrival process is to maximize the conversion of customer arrivals to customer orders.

**Customer Order Entry** The term customer order entry refers to customers informing the retailer what products they want to purchase and the retailer allocating products to customers. At a supermarket, order entry may take the form of customers loading all items that they intend to purchase onto their carts. At a mail order firm's telemarketing center or Web site, order entry may involve customers informing the retailer of the items and quantities they selected. The objective of the customer order entry process is to ensure that the order entry is quick, accurate; and communicated to all other supply chain processes that are affected by it.

**Customer Order Fulfillment** During this process, the customer's order is filled and sent to the customer. At a supermarket, the customer performs this process. At a mail order firm this process generally includes picking the order from inventory, packaging it, and shipping it to the customer. All inventories will need to be updated, which may result in the initiation of the replenishment cycle. In general, customer order fulfillment takes place from retailer inventory. In a build-to-order scenario, however, order fulfillment takes place directly from the manufacturer's production line. The objective of the customer order fulfillment process is to get the correct orders to customers by the promised due dates at the lowest possible cost.

**Customer Order Receiving** During this process, the customer receives the order and takes ownership. Records of this receipt may be updated and payment completed. At a supermarket, receiving occurs at the checkout counter. For a mail order firm, receiving occurs when the product is delivered to the customer.

**Replenishment Cycle**

The replenishment cycle occurs at the retailer/distributor interface and includes all processes involved in replenishing retailer inventory. It is initiated when a retailer places an order to replenish inventories to meet future demand. A replenishment cycle may be triggered at a supermarket that is running out of stock of detergent or at a mail order firm that is low on stock of a particular shirt.
The replenishment cycle is similar to the customer order cycle except that the retailer is now the customer. The objective of the replenishment cycle is to replenish inventories at the retailer at minimum cost, while providing high product availability. The processes involved in the replenishment cycle are shown in Figure 1.5 and include:

- Retail order trigger
- Retail order entry
- Retail order fulfillment
- Retail order receiving

**Retail Order Trigger** As the retailer fills customer demand, inventory is depleted and must be replenished to meet future demand. A key activity the retailer performs during the replenishment cycle is to devise a replenishment or ordering policy that triggers an order from the previous stage. The objective when setting replenishment order triggers is to maximize profitability by ensuring economies of scale and balancing product availability and the cost of holding inventory. The outcome of the retail order trigger process is the generation of a replenishment order that is ready to be passed on to the distributor or manufacturer.

**Retail Order Entry** This process is similar to customer order entry at the retailer. The only difference is that the retailer is now the customer placing the order that is conveyed to the distributor. This may be done electronically or by some other medium. Inventory or production is then allocated to the retail order. The objective of the retail order entry process is that an order be entered accurately and conveyed quickly to all supply chain processes affected by the order.

**Retail Order Fulfillment** This process is very similar to customer order fulfillment except that it takes place at the distributor. A key difference is the size of each order as customer orders tend to be much smaller than replenishment orders. The objective of the retail order fulfillment is to get the replenishment order to the retailer on time while minimizing costs.

**Retail Order Receiving** Once the replenishment order arrives at a retailer, the retailer must receive it physically and update all inventory records. This process involves product flow from the distributor to the retailer as well as information updates at the retailer and the flow of funds from the retailer to the distributor. The objective of the retail order receiving process is to update inventories and displays quickly and accurately at the lowest possible cost.

**Manufacturing Cycle**

The manufacturing cycle typically occurs at the distributor/manufacturer (or retailer/manufacturer) interface and includes all processes involved in replenishing distributor (or retailer) inventory. The manufacturing cycle is triggered by customer orders (as is the case with Dell), replenishment orders from a retailer or distributor (Wal-Mart ordering from P&G), or by the forecast of customer demand and current product availability in the manufacturer's finished-goods warehouse.
One extreme in a manufacturing cycle is an integrated steel mill that collects orders that are similar enough to enable the manufacturer to produce in large quantities. In this case, the manufacturing cycle is reacting to customer demand (referred to as pull process). Another extreme is a consumer products firm that must produce in anticipation of demand. In this case the manufacturing cycle is anticipating customer demand (referred to as a push process). The processes involved in the manufacturing cycle are shown in Figure 1.6 and include the following:

- Order arrival from the finished-goods warehouse, distributor, retailer, or customer
- Production scheduling
- Manufacturing and shipping
- Receiving at the distributor, retailer, or customer

**Order Arrival** During this process, a finished-goods warehouse or distributor sets a replenishment order trigger based on the forecast of future demand and current product inventories. The resulting order is then conveyed to the manufacturer. In some cases the customer or retailer may be ordering directly from the manufacturer. In other cases a manufacturer may be producing to stock a finished-products warehouse. In the latter situation, the order is triggered based on product availability and a forecast of future demand. This process is similar to the retail order trigger process in the replenishment cycle.

**Production Scheduling** This process is similar to the order entry process in the replenishment cycle where inventory is allocated to an order. During the production scheduling process, orders (or forecasted orders) are allocated to a production plan. Given the desired production quantities for each product, the manufacturer must decide on the precise production sequence. If there are multiple lines, the manufacturer must also decide which products to allocate to each line. The objective of the production scheduling process is to maximize the proportion of orders filled on time while keeping costs down.

**Manufacturing and Shipping** This process is equivalent to the order fulfillment process described in the replenishment cycle. During the manufacturing phase of the process, the manufacturer produces to the production schedule. During the shipping phase of this process, the product is shipped to the customer, retailer, distributor, or finished-product warehouse. The objective of the manufacturing and shipping process is to create and ship the product by the promised due date while meeting quality requirements and keeping costs down.

**Receiving** In this process, the product is received at the distributor, finished-goods warehouse, retailer, or customer and inventory records are updated. Other processes related to storage and fund transfers also take place.

**Procurement Cycle**

The procurement cycle occurs at the manufacturer/supplier interface and includes all processes necessary to ensure that materials are available for manufacturing to occur according to schedule. During the procurement cycle, the manufacturer orders components from suppliers that replenish the component inventories. The relationship is quite similar to that between a distributor and manufacturer with one significant difference. Whereas retailer/distributor orders are triggered by uncertain customer demand, component orders can be determined precisely once the manufacturer has decided what the production schedule will be. Component orders depend on the production schedule. Thus it is important that suppliers be linked to the manufacturer's production schedule. Of course, if a supplier's lead times are long, the supplier has to produce to forecast because the manufacturer's production schedule may not be fixed that far in advance.

In practice, there may be several tiers of suppliers, each producing a component for the next tier. A similar cycle would then flow back from one stage to the next. The processes in the procurement cycle are shown in Figure 1.7.
We do not detail each process here because this cycle has processes similar to those discussed in the context of other cycles.

**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 processes, execution is initiated in anticipation of customer orders. Therefore, at the time of execution of a pull process, customer demand is known with certainty whereas at the time of execution of a push process, demand is not known and must be forecast. Pull processes may also be referred to as reactive processes because they react to customer demand. Push processes may also be referred to as speculative processes because they respond to speculated (or forecasted) rather than actual demand. The push/pull boundary in a supply chain separates push processes from pull processes. At Dell, for example, the beginning of PC assembly represents the push/pull boundary. All processes before PC assembly are push processes and all processes after and including assembly are initiated in response to a customer order and are thus pull processes.

A push/pull view of the supply chain is very useful when considering strategic decisions relating to supply chain design. This view forces a more global consideration of supply chain processes as they relate to a customer order. Such a view may, for instance, result in responsibility for certain processes being passed on to a different stage of the supply chain if making this transfer allows a push process to become a pull process.

Let us consider two distinct supply chains that we have discussed and relate them to the push/pull and cycle views. One supply chain is a mail order company like L. L. Bean that receives customer orders through its telemarketing center or Web site. The other is a build-to-order computer manufacturer like Dell.

L. L. Bean executes all processes in the customer order cycle after the customer arrives. All processes that are part of the customer order cycle are thus pull processes. Order fulfillment takes place from product in inventory that is built up in anticipation of customer orders. The goal of the replenishment cycle is to ensure product availability when a customer order arrives. All processes in the replenishment cycle are performed in anticipation of demand and are thus push processes. The same holds true for processes in the manufacturing and procurement cycle. In fact, raw material like fabric is often purchased six to nine months before customer demand is expected. Manufacturing itself begins three to six months before the point of sale. All processes in the manufacturing and procurement cycle are thus push processes. The processes in the L. L. Bean supply chain break up into pull and push processes, as shown in Figure 1.8.
The situation is different for a build-to-order computer manufacturer like Dell. Dell does not sell through a reseller or distributor but directly to the consumer. Demand is not filled from finished-product inventory, but from production. The arrival of a customer order triggers production of the product. The manufacturing cycle is thus part of the customer order fulfillment process in the customer order cycle. There are
effectively only two cycles in the Dell supply chain: (a) a customer order and manufacturing cycle and (b) a procurement cycle, as shown in Figure 1.9.

All processes in the customer order and manufacturing cycle at Dell are thus classified as pull processes because they are initiated by customer arrival. Dell, however, does not place component orders in response to a customer order. Inventory is replenished in anticipation of customer demand. All processes in the procurement cycle for Dell are thus classified as push processes because they are in response to a forecast. The processes in the Dell supply chain break up into pull and push processes as shown in Figure 1.10.

One clear distinction between the two supply chains discussed earlier is that the Dell supply chain has fewer stages and more pull processes than the L. L. Bean supply chain. As we see in the following chapters, this fact has a significant impact on supply chain performance.
All supply chain processes in a firm can be classified into the following three macro processes as shown in Figure 1.11:

1. **Customer Relationship Management (CRM):** All processes that focus on the interface between the firm and its customers. It includes processes such as marketing, sales, order management, and call center management. At an industrial distributor like W. W. Grainger, CRM processes would include the preparation of catalogs and other marketing materials, management of the Web site, and management of the call center taking orders and providing service.

2. **Internal Supply Chain Management (ISCM):** All processes that are internal to the firm. ISCM processes include the planning of internal production and storage capacity, preparation of demand and supply plans, and internal fulfillment of actual orders. At W. W. Grainger, ISCM processes would include planning for the location and size of warehouses; planning for which products to carry at each warehouse; preparation of inventory management policies; and the picking, packing, and shipping of actual orders.

3. **Supplier Relationship Management (SRM):** All processes that focus on the interface between the firm and its suppliers. SRM processes include the evaluation and selection of suppliers, negotiation of supply terms, and communication regarding new products and orders with suppliers. At W. W. Grainger, SRM processes would include the selection of suppliers for various products, negotiation of pricing and delivery terms with suppliers, sharing of demand and supply plans with suppliers, and the placement of replenishment orders.

Observe that all three macro processes are aimed at serving the same customer. Thus, for a supply chain to be successful it is crucial that the three macro processes are well integrated. The importance of this integration in the context of supply chain software is discussed in Chapter 17. The organizational structure of the firm has a strong influence on the success or failure of the integration effort. In many firms, marketing is in charge of the CRM macro process, manufacturing handles the ISCM macro process, and purchasing oversees the SRM macro process with very little communication between them. It is not unusual for marketing and manufacturing to have two different forecasts when making their plans. This lack of integration hurts the supply chain's ability to match supply and demand effectively, leading to dissatisfied customers and high costs. Thus, firms should structure a supply chain organization that mirrors the macro processes and ensures good communication and coordination between the owners of processes that interact with each other.
1.4 THE IMPORTANCE OF SUPPLY CHAIN FLOWS

There is a close connection between the design and management of supply chain flows (product, information, and cash) and the success of a supply chain. Dell Computer is an example of a firm that has successfully used good supply chain practices to support its competitive strategy. In contrast, Quaker Oats’ acquisition of Snapple is an example in which the inability to design and manage supply chain flows led to failure. Most e-business failures can also be attributed to problems with the design and management of supply chain flows.

Dell has, over a relatively short period of time, become the world’s largest PC manufacturer. They have generated margins, profits, and, subsequently, market capitalization beyond any of their competitors’ PC businesses. Dell has attributed a significant part of its success to the way it manages flows-product, information, and cash-within its supply chain.

Dell's basic supply chain model is direct sales to customers. As distributors and retailers are bypassed, the Dell supply chain has only three stages-customers, manufacturer, and suppliers-as shown in Figure 1.12.

Because Dell is in direct contact with its customers, it has been able to finely segment them and analyze the needs and profitability of each segment. Close contact with their customers and an understanding of customers’ needs also allows Dell to develop better forecasts. To further improve the match between supply and demand, Dell makes an active effort to steer customers in real time, on the phone or via the internet toward PC configurations that can be built given the components available.

On the operational side inventory turns is a key performance measure that Dell watches very closely. Dell carries11–15 days’ worth of inventory; in contrast, the competition, selling through retailers, carries in the vicinity of eighty to one hundred days’ worth of inventory. If Intel introduces a new chip, the low level of inventory allows Dell to go to market with a PC containing the chip faster than the competition. If prices suddenly drop, as they often do, Dell has less inventory that loses value relative to its competitors. For some products, such as monitors manufactured by Sony, Dell maintains no inventory. The transportation company simply picks up the appropriate number of computers from Dell’s Austin plant and monitors from Sony’s factory in Mexico, matches them by customer order, and delivers them to the customers. This procedure allows Dell to save time and money associated with the extra handling of monitors.

The success of the Dell supply chain is facilitated by sophisticated information exchange. Dell provides real time data to suppliers on the current state of demand. Suppliers are able to access their components’ inventory levels at the factories along with daily production requirements. Dell has created customized Web pages so that its major suppliers can view demand forecasts and other customer-sensitive information, thus helping suppliers to get a better idea of customer demand and better match their production schedules to that of Dell. The company has production concentrated in five manufacturing centers—Brazil, China, Ireland, Malaysia, and Texas. Because demand at each location is relatively large and stable, suppliers are able to replenish component inventories regularly, allowing for low levels of component inventories to be maintained. In some cases, Dell carries only hours of component inventory at its factory. Dell’s low levels of inventory also help ensure that defects are not introduced into a large quantity of product. When a new product is launched, supplier engineers are stationed right in the plant. If a customer calls in with a problem, production is stopped and flaws are fixed in real time. As there is no finished product in inventory, the amount of defective merchandise produced is minimized.

Dell also manages its cash flows very effectively. By managing receivables and payables very closely, they are able to collect cash from their customers, on average, ten to fifteen days before they have to pay their suppliers.

Clearly, Dell’s supply chain design and their management of product, information, and cash flows play a key role in the company’s success. This approach has left Dell very well positioned in the PC industry. Given that the PC is to an extent a commodity, the competitive battlefield is more focused on supply chain responsiveness and efficiency. This bodes well for Dell.
Quaker Oats, with its acquisition of Snapple, provides an example in which failure to design and manage supply chain flows led to financial failure. In December 1994, Quaker purchased Snapple, a producer of bottled natural drinks such as teas, at a cost of $1.7 billion. Gatorade, the top-selling brand in the sports drink segment, was Quaker's most successful beverage. Gatorade was very strong in the south and the southwest of the United States while Snapple was strong in the northeast and on the west coast.

Quaker announced that a major motivation of the merger was the potential synergies between the two distribution systems of Snapple and Gatorade. The company, however, was unable to take advantage of these synergies. Problems stemmed from disparate manufacturing facilities to different customer types. Gatorade was manufactured in plants owned by Quaker while Snapple was produced under contract by outside plants. Gatorade sold significant amounts through supermarkets and grocery stores while Snapple sold primarily through restaurants and independent retailers. Over the two years following their acquisition of Snapple, Quaker was unable to gain much synergy between the two distribution systems in their attempts to merge them. Just twenty eight months later, Quaker sold Snapple to Triarc Companies for about $300 million, about 20 percent of the purchase price. The inability to achieve synergies between the two supply chains was a significant reason for the failure of Snapple at Quaker.

The failure of many e-businesses such as Webvan and Kozmo.com can be attributed to their inability to manage supply chain flows effectively. Webvan was unable to bring the cost of grocery picking and delivery to a competitive level. The recent success of Amazon.com has been primarily driven by the improvements in the management of product inventories and delivery.

**Key Point** Supply chain decisions play a significant role in the success or failure of a firm.

### 1.5 Examples of Supply Chains

In this section, we consider several supply chains and raise questions that would have to be answered during the design, planning, and operations phases of these supply chains. In later chapters, we discuss concepts and present methodologies that can be used to answer these questions.

**Gateway: A Direct Sales Manufacturer**

Gateway is a manufacturer of PCs that sells directly to customers who place orders at Gateway retail stores, through the telephone, or via the Internet. The company was founded in 1985 and started as a direct sales manufacturer with no retail footprint. In 1996, Gateway was one of the first PC manufacturer’s to start selling PCs online. Over the years Gateway expanded its operations worldwide with sales and manufacturing presence in Europe and Asia Pacific. In 1999, the company had three plants in the United States, a plant in Ireland, and one in Malaysia.

In the late 1990s, Gateway introduced an aggressive strategy of opening Gateway retail stores throughout the United States. They invested in many retail stores, increasing their selling, general, and administrating expenses (SG&A) from 12.5 percent of sales in 1997 to 15.1 percent of sales in 1999. As of January 2002, Gateway had about 280 retail stores in the United States. Gateway’s strategy has been to not carry any finished-goods inventory at the retail stores but simply use these stores for customers to try the PCs and obtain help in deciding on the right configuration to purchase. Once customers place their order, PCs are manufactured to order and shipped from one of the assembly plants.

Initially, investors rewarded Gateway for this strategy and raised the stock price to over $80 per share in late 1999. By November 2002, however, Gateway shares had dropped to below $4 and Gateway had lost a significant amount of money.

In 2001, Gateway decided to close all overseas operations to focus on its business in the United States. Plants in Ireland and Malaysia were shut. The company has entered into contracts with third parties to provide service and support to customers outside the United States.

Gateway has also shut its production facility in Salt Lake City. The company has closed several of its retail stores in the United States but has not fundamentally changed the way they are used. Gateway has also decided to reduce the number of configurations that will be offered to customers in an effort to lower costs.

The following supply chain decisions have a bearing on the performance of Gateway:

1. **Why did Gateway have multiple production facilities in the United States?** What advantages or disadvantages does this strategy offer relative to Dell, which has one facility? How does Gateway decide which production facility will produce and ship a customer order?
2. **What factors did Gateway consider when deciding which plants to close?**
3. **Why does Gateway not carry any finished-product inventory at its retail stores?**
4. **Should a firm with an investment in retail stores carry any finished-goods inventory?** What are the characteristics of products that are most suitable to be carried in finished-goods inventory? What characterizes products that are best manufactured to order?
5. **Is the Dell model of selling directly without retail stores always less expensive than a supply chain with retail stores?**
6. **What are the supply chain implications of Gateway’s decision to offer fewer configurations?**
Answers to these questions determine the appropriateness of Gateway's supply chain decisions. Manufacturers like HP that sell both direct and through resellers will need a different supply chain design to best support their strategy. How should they design and manage their supply chains?

7-Eleven: A Convenience Store

With over 23,000 stores in about 20 countries, 7-Eleven is one of the largest convenience store chains in the world. It has about 9,000 stores in Japan and almost 6,000 in the United States. Its growth in Japan has been phenomenal given that the first 7-Eleven store opened there in 1974. 7-Eleven Japan is one of the most profitable companies listed on the Tokyo stock exchange. It has seen tremendous growth in sales and profitability while simultaneously decreasing its inventory relative to sales. 7-Eleven Japan's success is attributed primarily to its supply chain design and management ability.

7-Eleven Japan aims to provide customers with what they want, when they want it. From a strategic perspective, one of the company's key objectives is to micro-match supply and demand by location, season, and time of day. 7-Eleven designs and manages location, inventory, transportation, and information to support this objective.

7-Eleven Japan follows a dominant location strategy and opens new stores in target areas to establish or enhance a strong presence. They are present in about half of the prefectures (roughly equivalent to a county in the United States). 7-Eleven has a strong presence, however, with several stores in each prefecture where they are located. 7-Eleven's dominant location strategy allows the company the benefits of consolidation in both warehousing and transportation.

In Japan, fresh food constitutes a significant percentage of 7-Eleven's sales. Most of the fresh food is cooked off-site and delivered to the stores. A store placing an order by 10 A.M. has it delivered by dinnertime the same day. There are at least three fresh food deliveries a day per store so that the stock can change for breakfast, lunch, and dinner. All stores are electronically connected to the head office, distribution centers (DCs), and suppliers. All store orders are passed on to the suppliers who package store-specific orders and deliver them to the DC. At the DC, all orders of like products (categorized by temperature) from different suppliers are combined and delivered to the stores. Each delivery truck delivers to more than one store and tries to visit stores during the off-peak hours. 7-Eleven Japan has made an effort to have no direct store delivery from vendors to the stores. Rather, all deliveries pass through and are aggregated at a 7-Eleven DC or warehouse from which they are shipped to the stores. Note that the location strategy helps facilitate this supply strategy.

In the United States, 7-Eleven is taking a similar approach to the one used in Japan. Fresh foods are being introduced into the stores. 7-Eleven has once again decided to avoid on-site cooking by having suppliers cook the fresh food for them. These foods are then delivered to store on a daily basis. In the United States, 7-Eleven has tried to replicate the Japanese model with combined DCs where product is received from suppliers and then shipped to stores. The success of this strategy is reflected by the improved performance of 7-Eleven in the United States. In the United States, however, a large fraction of products are delivered to stores by a distributor and not from the 7-Eleven DC.

In both Japan and the United States, 7-Eleven has invested significant money and effort on a retail information system. Scanner data are collected and analyzed. The resulting information is then made available to headquarters and the stores for use in ordering, product assortment, and merchandising. Information systems play a key role in 7-Eleven's ability to micro-match supply and demand. 7-Eleven has made clear choices in the design of its supply chain. Other convenience store chains have not always made the same choices. We can ask a variety of questions, listed next, concerning 7-Eleven's supply chain choices and its key success factors.

1. What factors influence the decision regarding the opening and closing of stores? Why does 7-Eleven choose to have a preponderance of its stores in a particular location?
2. Why has 7-Eleven chosen off-site preparation of fresh foods and subsequent delivery to stores?
3. Why does 7-Eleven Japan discourage direct store delivery from vendors and make an effort to move all products through combined DCs? How does the presence of the distributor delivering to the stores affect the performance of the delivery system in the United States?
4. Where are DCs located and how many stores does each center serve? How are stores assigned to DCs?
5. Why does 7-Eleven combine fresh food shipments by temperature?
6. What point-of-sales data does 7-Eleven gather and what information is made available to store managers to assist them in their ordering and merchandising decisions? How should the information system be structured?

W. W. Grainger and McMaster Carr: MRO Suppliers

W. W. Grainger and McMaster Carr sell MRO products. Both companies have catalogs that they make available, as well as Web pages through which orders can be placed. W. W. Grainger also has several hundred stores throughout the United States. Customers can walk into a store, call in an order, or place it via the Web. W. W. Grainger orders are either shipped to the customer or picked up by the customer at one of the stores. McMaster Carr, in contrast, ships all orders. W. W. Grainger has several DCs that both replenish stores and fill customer orders. McMaster has DCs from which all orders are filled. Neither McMaster nor W. W. Grainger manufacture any product. They primarily serve the role of a distributor or retailer. Their success is largely linked to their supply chain management ability.
Both firms offer several hundred thousand products to their customers. Each firm stocks about 100,000 products with the rest being obtained from the supplier as needed. Both firms face the following strategic and operational issues:

1. How many DCs should there be and where should they be located?
2. How should product stocking be managed at the DCs? Should all DCs carry all products?
3. What products should be carried in inventory and what products should be left with the supplier?
4. What products should W. W. Grainger carry at a store?
5. How should markets be allocated to DCs in terms of order fulfillment? What should be done if an order cannot be completely filled from a DC? Should there be specified backup locations? How should they be selected?
6. How should replenishment of inventory be managed at the various stocking locations?
7. How should Web orders be handled relative to the existing business? Is it better to integrate the Web business with the existing business or to set up separate distribution?
8. What transportation modes should be used for order fulfillment and stock replenishment?

**Toyota: A Global Auto Manufacturer**

Toyota Motor Corporation is Japan's top auto manufacturer and has experienced significant growth in global sales over the last two decades. A key issue facing Toyota is the design of its global production and distribution network. Part of Toyota's global strategy is to open factories in every market it serves. Toyota must decide what the production capability of each of the factories will be, as this has a significant impact on the desired distribution system. At one extreme, each plant would be equipped only for local production. At the other extreme, each plant would be capable of supplying every market. Prior to 1996, Toyota used specialized local factories for each market. After the Asian financial crisis in 1996/1997, Toyota focused on redesigning its plants so that they could be shifted quickly to exporting to markets that remain strong. Toyota calls this strategy "global complementation."

Whether to be global or local is also an issue for Toyota's parts plants. Should they be designed for local consumption or should there be few parts plants globally that supply multiple assembly plants?

For any global manufacturer like Toyota, several questions arise regarding the configuration and capability of the supply chain:

1. Where should the plants be located and what degree of flexibility should be built into each? What capacity should each plant have?
2. Should plants be able to produce for all markets or only specific contingency markets?
3. How should markets be allocated to plants and how frequently should this allocation be revised?
4. What kind of flexibility should be built into the distribution system?
5. How should this flexible investment be valued?
6. What actions may be taken during product design to facilitate this flexibility?

**Amazon.com: An E-Business**

Amazon.com sells books, music, and other items over the Internet and is one of the pioneers of consumer e-business. Amazon is based in Seattle and started by filling all orders using books purchased from a distributor in response to customer orders. This practice differs from that of a traditional bookstore that purchases directly from publishers and stocks books in anticipation of customer orders. Today, Amazon has six warehouses where it holds inventory. Amazon stocks best-selling books, though it still gets other titles from distributors or publishers. It uses the U.S. Postal Service and other package carriers like UPS and FedEx to send books to customers.

Traditional booksellers like Borders and Barnes and Noble have also started selling using the Internet channel. Barnes and Noble has set up BarnesandNoble.com as a separate company, whereas Borders uses Amazon to fulfill its online orders after initially trying to operate an online business. In the case of Barnes and Noble, the retail store and the online supply chains share warehousing and transportation to some extent. This is a departure from their original strategy when BarnesandNoble.com was not visible in any Barnes and Noble Bookstore.

Several questions arise concerning how Amazon is structured and how traditional booksellers have responded:

1. Why is Amazon building more warehouses as it grows? How many warehouses should it have and where should they be located?
2. What advantages does selling books via the Internet provide over a traditional bookstore? Are there any disadvantages of selling via the Internet?
3. Why does Amazon stock best-sellers while buying other titles from distributors?
4. Does the Internet channel provide greater value to a bookseller like Borders with retail outlets or to a company like Amazon?
5. Should traditional booksellers like Barnes and Noble integrate e-commerce into their current supply chain or manage it as a separate supply chain?
6. For what products does the e-commerce channel offer the greatest advantage? What characterizes these products?
1.6 SUMMARY OF LEARNING OBJECTIVES

1. Describe the cycle and push/pull views of a supply chain.

A cycle view of a supply chain divides processes into cycles, each performed at the interface between two successive stages of a supply chain. Each cycle starts with an order placed by one stage of the supply chain and ends when the order is received from the supplier stage. A push/pull view of a supply chain characterizes processes based on their timing relative to that of a customer order. Pull processes are performed in response to a customer order while push processes are performed in anticipation of customer orders.

2. Classify the supply chain macro processes in a firm.

All supply chain processes can be classified into three macro processes based on whether they are at the customer or supplier interface or are internal to the firm. The CRM macro process consists of all processes at the interface between the firm and the customer that work to generate, receive, and track customer orders. The ISCM macro process consists of all supply chain processes that are internal to the firm and work to plan for and fulfill customer orders. The SRM macro process consists of all supply chain processes at the interface between the firm and its suppliers that work to evaluate and select suppliers and then source goods and services from them.

3. Identify the three key supply chain decision phases and explain the significance of each one.

Supply chain decisions may be characterized as strategic (design), planning, or operational depending on the duration over which they apply. Strategic decisions relate to supply chain configuration. These decisions have a long-term impact lasting several years. Planning decisions cover a period of a few months to a year and include decisions such as production plans, subcontracting, and promotions over that period. Operational decisions span from minutes to days and include sequencing production and filling specific orders. Strategic decisions define the constraints for planning decisions and planning decisions define the constraints for operational decisions.

4. Discuss the goal of a supply chain and explain the impact of supply chain decisions on the success of a firm.

The goal of a supply chain should be to maximize overall supply chain profitability. Supply chain profitability is the difference between the revenue generated from the customer and the total cost incurred across all stages of the supply chain. Supply chain decisions have a large impact on the success or failure of each firm because they significantly influence both the revenue generated as well as the cost incurred. Successful supply chains manage flows of product, information, and funds to provide a high level of product availability to the customer while keeping costs low.

DISCUSSION QUESTIONS

1. Consider the purchase of a can of soda at a convenience store. Describe the various stages in the supply chain and the different flows involved.
2. Why should a firm like Dell take into account total supply chain profitability when making decisions?
3. What are some strategic, planning, and operational decisions that must be made by an apparel retailer like The Gap?
4. Consider the supply chain involved when a customer purchases a book at a bookstore. Identify the cycles in this supply chain and the location of the push/pull boundary.
5. Consider the supply chain involved when a customer orders a book from Amazon. Identify the push/pull boundary and two processes each in the push and pull phase.
6. In what way do supply chain flows affect the success or failure of a firm like Amazon? List two supply chain decisions that have a significant impact on supply chain profitability.

BIBLIOGRAPHY