

MODULE 1

SUPPLY CHAIN DESIGN

Section A: Develop the Supply Chain Strategy



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This section introduces the competitive advantage of various organizational strategies. It also addresses how to develop a complementary supply chain strategy for those strategies, including how to resolve misalignments or gaps. Some tools and techniques that can be used to help in understand the economic environment and assess an organization's strategic strengths and weaknesses will also be covered.

There's a kind of magic in some words, "strategy" and "strategic" being key examples. Place "strategic" in front of the name of any business process, and suddenly that process acquires an aura of great importance. Strategic objectives cry out to be achieved in a way that simple objectives do not. **Strategic planning**, the process of developing a strategic plan, sounds considerably more sophisticated and powerful than plain old planning. There's a reason those words have such power. Strategy, originally a military term, is how generals marshal all available resources in pursuit of victory. Strategy wins football games and chess matches—or loses them.

It's really the same in the business world. Each company has a business strategy that paints a broad picture of how it will compete in the marketplace. According to the *APICS Dictionary*, 16th edition, a **strategic plan** describes

how to marshal and determine actions to support the mission, goals, and objectives of an organization. [It] generally includes an organization's explicit mission, goals, and objectives and the specific actions needed to achieve those goals and objectives.

Since business strategy is like military strategy in that it requires the marshaling and organizing of all its resources, then it becomes clear that the business's supply chain can be its most potent strategic resource. Designing and building the right supply chain, one that promotes the business strategies, may just be the most powerful way to gain an edge on the competition, to move faster, deliver more value, and be more flexible in the face of both steady change and surprises. The supply chain strategy is a complex and evolving way that organizations use to distinguish themselves in the competitive contest to create value for their customers and investors.

In Exhibit 1-1 you can see how the direction of an organization is predicated on its business strategy. Of course many organizations now also use mission and vision statements to give clarity to their purpose.

*Exhibit 1-
1:
Alignment
of
Strategies*



If these strategies are not aligned, the direction and fit will be askew. All three strategies are linked and dependent. The *APICS Dictionary*, 16th edition, differentiates between business and organizational strategy (listed as "strategy" in the *Dictionary*) as follows:

Business strategy. A plan for choosing how to compete. Three generic business strategies are (1)

least cost, (2) differentiation, and (3) focus.

Strategy [organizational]. For an enterprise, identifies how the company will function in its environment. Specifies how to satisfy customers, how to grow the business, how to compete in its environment, how to manage the organization and develop capabilities within the business, and how to achieve financial objectives.

Supply chain strategy is then a strategy for how the supply chain will function in its environment to meet the goals of the organization's business and organizational strategies. Competitive advantages are closely related to business strategy because they outline the advantages the organization should realize once it has decided how it will compete. A business model is the organization's business and organizational strategy formalized into a business plan.

The business model, competitive advantages, and external influences on supply chain strategy are the first subjects in this section. Then you will explore supply chain strategy and how to resolve gaps between the as-is and desired strategies. You will also learn about some tools to achieve supply chain strategy.

Processes for developing the supply chain strategy

The key processes that supply chain managers need to be able to perform related to developing the supply chain strategy are

- Aligning with the business strategy
- Creating the supply chain strategy.

The following is a general overview of these processes. The information required to plan and execute these processes is presented in this section's chapters.

Aligning with business strategy

The process of aligning with the business strategy involves the following steps:

- Reviewing the organization's business plan, financial statements, and other information and analyses related to business strategy to learn
 - The organization's overall strategic objectives, including its vision, key business policies, and cost and revenue objectives
 - Its value proposition for customers and stakeholders, including its core capabilities (and areas it chooses to avoid)
 - How it will differentiate itself in the marketplace to compete and grow in the face of change and uncertainty
- Gathering information on the external environment, including
 - Customer requirements
 - Competitor business and supply chain strategies
 - Competitor supply chain maturity
 - Market size and market share
 - Overall, regional, local, and industry market conditions
 - Global risks and opportunities

- Reviewing current supply chain capacity, resilience, sustainability, and adaptability to understand the current state of the supply chain (actualized strategy)
- Analyzing actual alignment to business strategy and the current environment

Creating supply chain strategy

The process of creating a supply chain strategy that is complementary to the business model and the current environment involves the following steps:

- Defining customer service objectives for business-to-business and/or business-to-consumer
- Selecting a revenue model, including direct and/or indirect and sales channels for each customer segment
- Mapping supply chain objectives to business objectives
- Aligning in-house versus contracted supply chain operating models and cost structure to organizational core capabilities and strategy
 - Aligning operating model (e.g., make-to-stock)
 - Aligning cost structure or asset footprint (e.g., property, plant, and equipment and human resources for planning, sourcing, production, and logistics by region)
- Documenting the strategy, including
 - Clarifying the supply chain value proposition
 - Creating a network model
- Presenting and marketing the strategy to get executive or supply chain partner support and approval
- Accepting feedback and making agreed-upon changes
- Getting approval for the strategy
- Comparing supply chain strategy to actual supply chain capacity, resilience, sustainability, and adaptability
- Creating action plans to resolve misalignments or gaps between desired and actual supply chain strategy

Note that these action plans often involve supply chain design (or redesign), which is addressed in a different section.

Chapter 1: Introduction to Supply Chains

This chapter is designed to

- Describe fundamental concepts of supply chains and supply chain management
- Define and illustrate the supply chain in terms of entities, structures, and flows
- Differentiate between vertical and horizontal (lateral) integration
- Describe common supply chain management core capabilities
- Differentiate the supply chain in terms of cost structures and revenue models
- Describe the stages of supply chain evolution globally and within companies

Topic 1: Supply Chain Models

Definitions

According to the *APICS Dictionary*, 16th edition, a **supply chain** is a

global network used to deliver products and services from raw materials to end customers through an engineered flow of information, physical distribution, and cash.

A supply chain, in this view, comprises a network of both entities and processes (the engineered flow). The massive chains that interest us in this course—the ones that run through corporations such as Walmart, Boeing, or Caterpillar—are decidedly global in scope.

The *APICS Dictionary*, 16th edition, defines **supply chain management** as

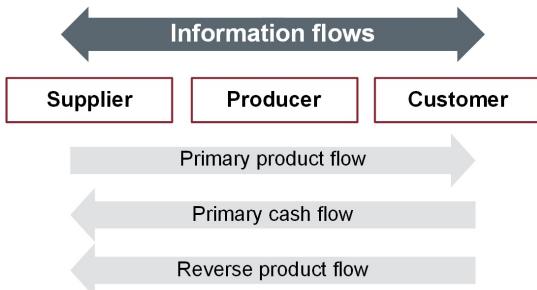
the design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand, and measuring performance globally.

(In this case, “globally” can mean either worldwide or applying to the supply chain as a whole rather than to a particular entity within the chain.)

Basic supply chain

Exhibit 1-2 illustrates a very basic supply chain with three entities—a producer with one supplier and one customer.

*Exhibit
1-2:
Basic
Supply
Chain
for a
Product*



Three entities and four flows

These “entities” that perform the processes can be business or governmental organizations or individuals. They can also be departments or functional areas or individuals within a larger organization; there are internal as well as external supply chains. For the most part the model applies to corporations.

Most work on supply chains involves a manufacturing company in the middle (although service companies also have supply chains) with a supplier of materials or components on the upstream side and a customer on the downstream side. Technically, a supply chain needs only those three entities to exist; global supply chains have many more.

The simplified chain in Exhibit 1-2 might be made up of these organizations:

- A supplier, a provider of goods or services or a seller with whom the buyer does business, as opposed to a vendor, which is a generic term referring to all sellers in the marketplace. The supplier provides materials, energy, services, or components for use in producing a product or service. These could include items as diverse as sugar cane, fruit, roofing nails, fabric, computer chips, aircraft turbines, electrical power, or transportation services.
- A producer that receives services, materials, supplies, energy, and components to use in creating finished products, such as dress shirts, packaged dinners, airplanes, legal counsel, or guided tours.
- A customer that receives shipments of finished products to deliver to its customers, who wear the shirts, eat the packaged dinners, fly the planes, or turn on the lights.

Four basic flows connect the supply chain entities together:

- The **flow of information** back and forth along the supply chain (also back and forth within the entities and between the chain and external entities, such as governments, markets, and competitors)
- The **primary product flow**, including physical materials and services from suppliers through the intermediate entities that transform them into consumable items for distribution to the final customer
- The **primary flow of cash** from the customer back upstream toward the raw material supplier
- The **reverse flow of products returned** for repairs, recycling, remanufacturing, or disposal. This is called the reverse supply chain, and it is handled by reverse logistics, which involves different arrangements than the forward logistics that carried materials and products in the other direction. This topic is discussed in more detail in another section.

The supply chain concept seems fairly solid when you consider the chain as linked organizations—supplier, producer, and customer connected by product, information, and payment flows. But the supply chain is more accurately viewed as a set of linked processes that take place in the extraction of materials for transformation into products (or perhaps services) for distribution to customers. Those processes are carried out by the various functional areas within the organizations that constitute the supply chain. When considered as a set of processes rather than a succession of companies, the supply chain becomes just a little more difficult to conceptualize.

Value and balance

Here are some other highlights of supply chain management.

- **Supply chain management is about creating net value.** Early efforts at managing supply chains often focused only on cost reduction—on making the chain leaner. Unfortunately, these efforts sometimes reduced the ability to create value more than they reduced costs, for a net negative effect. As we'll see, there's more to creating value than simply squeezing costs out of the supply chain.
- **There should be value-creating activities in the supply chain that transcend the activities of particular entities in the chain.** Supply chains are generally organized by one strong company—a channel master or nucleus firm such as a manufacturer, a designer and patent owner, or a powerful retailer—which often manages the overarching value-creating activities. Nevertheless, the chain has to produce value for each stakeholder in addition to generating value for consumers or investors. (The *APICS Dictionary*, 16th edition, defines **stakeholders** as “people with a vested interest in a company, including managers, employees, stockholders, customers, suppliers, and others.”)
- **Managing supply chains requires balancing competing interests.** Given the complicated nature of group dynamics, this can be a challenging task, especially in global supply chains. Consider the rivalries that arise among the 50 American states, the 28 nations in the European Union, the various sects of any world religion, and the divergent cultures around the globe.

Many variations

There are many variations on the basic supply chain model presented so far. Here are some basic points to keep in mind:

- A supply chain involves, directly or indirectly, everyone and everything required to extract materials, transform them into a product, and sell the product to a user.
- Supply chains include various entities, such as raw material extractors, service and component suppliers, a material product manufacturer or a producer of services, distributors, and end customers.
- Supply chain structures vary based on demand history, business focus, and needs for connectivity, technology, and equipment.
- Supply chains can be viewed in terms of processes, such as the gathering and processing of marketing data, distribution and payment of invoices, processing and shipping of materials, scheduling, fulfillment of orders, and so forth. Such functions cut across entities.
- Supply chains include various flows as well as various entities. Materials and services flow from suppliers toward customers; payment flows from customers toward suppliers; information flows both ways. Supply chains also run in reverse, starting with the customer who sends back such items as

components for replacement or repair, goods for remanufacture, and obsolete goods for recycling or disposal. The reverse chain, like the forward chain, comprises information flows and cash or credits.

Supply chain expertise is so important in today's business world that Gartner conducts its annual survey to identify the top 25 supply chain leaders. Check the online Resource Center for a link to those survey results and to see which companies are top-ranked for their supply chain management expertise.

Vertical vs. lateral integration

Companies have generally pursued one of two types of supply chain management, called vertical integration and lateral (or horizontal) integration.

Vertical integration

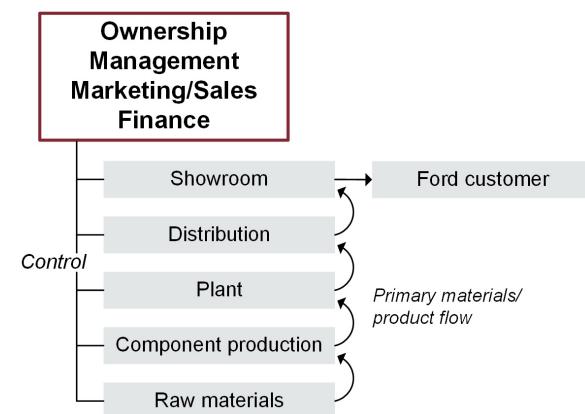
Vertical integration, or vertical supply chain management, refers to the practice of bringing the supply chain inside one organization. An example is a paper company that owns its land and trees, replanting for future harvests, owns the related equipment it uses, and manages all of its product processing, palletizing, and shipping. (The company purchases only its chemicals from an outside source.)

By bringing many supply chain activities in-house and putting them under corporate management, vertical integration solves the problem of who will design, plan, execute, monitor, and control supply chain activities.

A vertically integrated enterprise may grow from an entrepreneurial base by adding departments and layers of management to accommodate expansion, or it may be built through mergers and acquisitions to acquire more supply chain capabilities. In an attempt to create a self-sufficient enterprise, Henry Ford owned iron ore mines, steel mills, and a fleet of ships as well as the manufacturing plants and showrooms that built and distributed the cars bearing his name.

Exhibit 1-3 illustrates the vertical integration of a supply chain.

*Exhibit 1-3:
Vertical
Integration/Supply
Chain
Management of
Henry Ford*



The primary benefit of vertical integration is control. A department or wholly owned subsidiary with no independent presence in the marketplace can't deal with competitors to sell its components or services at a

higher price. Its operations are completely visible to the parent company (at least in theory) and can be synchronized with other company functions by directives from the top. Its schedules, workforce policies, locations, amounts produced—all aspects of its business—are controlled by the overarching management.

While the vertical structure still persists in some companies, it is very challenging to be fully integrated end to end.

Lateral (horizontal) integration

It's difficult for one corporation to garner the expertise needed to excel in all elements of the supply chain, and it increases their risk, so corporations around the globe have turned instead to outsourcing those aspects of their business in which they judge themselves to be least effective. In this **lateral integration**, an organization specializes in its core competencies and relies on other specialists for the rest of the supply chain. Corporate ownership loses control of the outsourced activities and deals separately with members of the chain as suppliers or customers. Each will focus on their core competencies, such as extraction or production, and do business with each other through discrete transactions or longer-term contracts.

For example, Philips, a manufacturer of light bulbs, uses third-party providers for some of its supply chain activities. Ford divested itself of the production of many components, as Chrysler Corporation shed its Mopar (motor parts) division and General Motors divested its component supplier as a separate organization, Delphi Corporation. The same organizations might then expand laterally, for example, by investing in their competencies or merging with direct competitors.

Lateral integration has replaced vertical integration as the favored approach to managing the myriad activities in the supply chain. This horizontal approach is assumed in most supply chain illustrations, including the ones featured so far in this text. Lateral chains are now the way of the world and, therefore, the major focus of supply chain theory and application.

Some Japanese companies favor an intermediate form of integration called "keiretsu." The *APICS Dictionary*, 16th edition, defines **keiretsu** as

A form of cooperative relationship among companies in Japan where the companies largely remain legally and economically independent, even though they work closely in various ways such as financial backing. A member of a keiretsu generally owns a limited amount of stock in other member companies. A keiretsu generally forms around a bank and a trading company, but "distribution" (supply chain) keiretsu alliances have been formed of companies ranging from raw material suppliers to retailers.

Among the reasons for relying on a lateral supply chain, the following stand out:

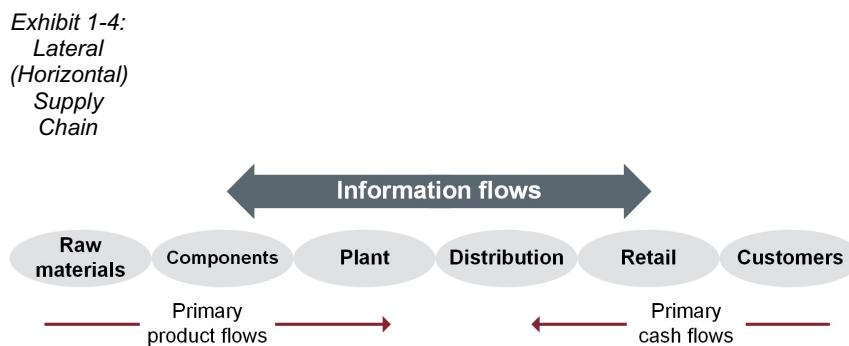
- **To achieve economies of scale and scope.** No matter how large the corporation, its internal supply chain functions lack economies of scale when compared with the potential capacity of an independent provider of the same product or service. Moreover, a specialist organization can increase its market share by internal growth or grow through lateral mergers with direct competitors or other organizations who have complementary core competencies.
- **To improve business focus and expertise.** Vertical integration, in a globally competitive market, multiplies the complexity of managing disparate businesses spread across international borders, time

zones, and oceans. The independent company that focuses entirely on its particular business can develop more expertise than an in-house department, leading to more attractive pricing, higher quality, or both.

- **To leverage communication and production competencies.** Today many of the barriers to doing business at a distance have been reduced or minimized. Nearly instantaneous communication means that information can be shared simultaneously by videoconference or in internal organization web boards or chat rooms. There are advantages to using already established companies that know their local markets. Many clothing companies in Europe, for example, work through Dutch logistics centers to take advantage of Holland's central location and because a number of specialized companies have sprung up there with well-developed capabilities in handling both the distribution and the return of clothing.

Despite the benefits of the lateral supply chain, however, synchronizing the activities of a network of independent companies can be enormously challenging. What each company gains in scale, scope, and focus, it may lose in ability to see and understand the larger supply chain processes.

Exhibit 1-4 shows a lateral supply chain.



Supply chain examples

Consider, as a stripped-down supply chain model, a street vendor who sells just a few light snacks. This is a familiar sight on warm summer days around the globe, whether it is fresh crepes in Paris, roasted chestnuts in New York, or small servings of spicy tapas in South America. In many ways, the food vendor on the street resembles small family businesses that exist all across the world.

The supplier is probably a small wholesale food distributor that sells basic ingredients to many food kiosks. The worker is the “producer” who turns the raw ingredients into crepes, roasted nut mixes, or a variety of easy-to-eat tapas. The stand, operated by one or two owners, is the retailer that sells the finished delicacies to the customers.

Notice that even in this simplest of supply chains, the basic model needs amplification. For instance, there are more suppliers than one. While flour and nuts may be procured from the same supplier, water to warm the stainless steel food containers comes from the employee's kitchen tap, and the supplier of that water is a government entity rather than a business. Electricity is supplied to light this mini “manufacturing center.”

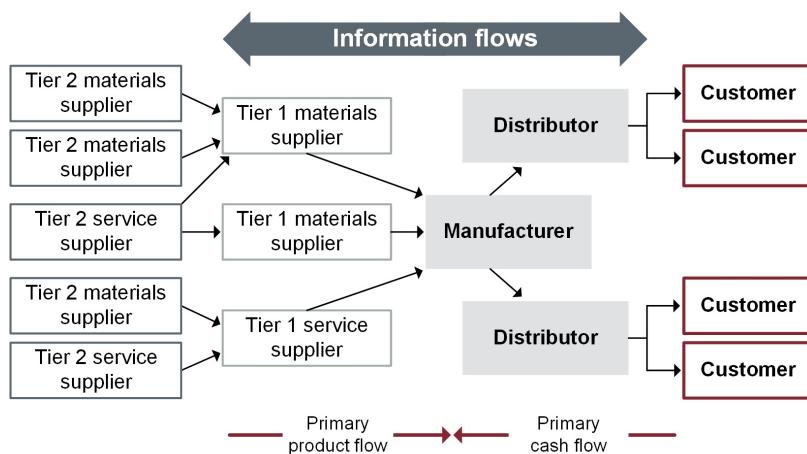
Nearby is a food preparation area with refrigeration for storing the perishables plus shelves and drawers to

hold basic supplies. There is also wood to build the stand and a white board and markers for making signs to advertise the day's offerings. Somewhere in the supply chain, though they remain invisible in our model, are the suppliers' suppliers, who bring materials, components, or services to the food wholesaler and the utility companies.

Manufacturing supply chain model

In Exhibit 1-5, a second tier of suppliers and more distribution centers and customers have been added.

*Exhibit 1-5:
Manufacturing
Supply Chain
Model*



Discussions of supply chains typically put manufacturing at the center and suppliers of components to the immediate left. These days, the nucleus firm may actually be a designer of products and a decision maker who outsources all manufacturing. Alternately, it may be that component suppliers are the most crucial consideration when designing and managing a supply chain for manufactured products, but utilities and other services are important contributors to the cost of operations.

The exhibit also shows that Tier 1 suppliers have their own suppliers in Tier 2. The wholesale food distributor that supplies the daily ingredients and raw materials for the menu items has its material and service suppliers—and they have their suppliers, and so forth. The flour for the crepes, for instance, is not a raw material but a product with its own supply chain that begins in a farmer's wheat field and is processed in a plant, shipped to a wholesaler, and distributed to the corner store. No matter how far you travel toward the left, you will never run out of new tiers of suppliers.

Even a raw material extractor, such as a coal mine, has its own suppliers of extraction machinery and services. In fact, the coal mine may ship coal to a generating plant that supplies power to the manufacturer that produces a machine that is shipped to a distributor that sells mining equipment to the same mine that began the process; supply chains can double back on themselves. (A distributor is a business that does not manufacture its own products but purchases and resells these products.)

Service industry supply chains

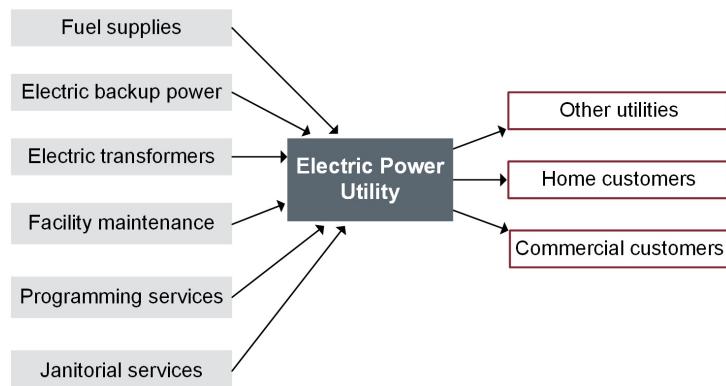
According to the APICS Dictionary, 16th edition, a company in the **service industry** is

- 1) In its narrowest sense, an organization that provides an intangible product (e.g., such as medical or legal advice). 2) In its broadest sense, all organizations except farming, mining, and manufacturing. Includes retail trade; wholesale trade; transportation and utilities; finance, insurance, and real estate; construction; professional, personal, and social services; and local, state, and federal governments.

In the case of our food vendor, services most obviously include utilities, transportation, warehousing, carpentry, and cleanup, among others. Utilities, which are suppliers to all manufacturers, are crucial considerations when locating plants and warehouses. If water and electricity (or natural gas, or both) are not available at a proposed site, they cannot be readily made available.

Service-oriented supply chains also require sophisticated management. Exhibit 1-6 illustrates, in simple form, the supply chain of an electric utility. It receives products, services, and supplies of its own and dispenses its services into three distribution channels: home customers, commercial customers, and other utilities.

*Exhibit
1-6:
Electric
Utility
Supply
Chain*



Specialized supply chains

Service industries are included in the category of specialized supply chains, as are humanitarian and disaster relief, nonprofits, and retailers. Other supply chains that might be considered specialized are industry-specific, virtual or e-business, or small- or medium-size companies' chains. Maintenance, repair, and operating supplies (MRO) (discussed in the "Inventory" section) might also be considered an example of a specialized supply chain but has become much more mainstream now.

If your organization is running one of these types of supply chains, learning how it differs from the large design- and manufacturing-oriented supply chains described elsewhere in these materials is critical.

However, even if a supply chain manager doesn't operate a specialized supply chain, studying them can help you learn from their experiences. Here are some examples:

- A humanitarian and disaster relief supply chain has to be developed quickly yet be resilient against theft, misappropriation, and transportation mode disruptions. Since organizations that provide humanitarian aid and disaster relief are continually operating in an environment filled with uncertainty,

they learn to maximize responsiveness. They become agile in operating a supply chain where supply and demand are routinely unbalanced, where demand can spike quickly, and where roads, electricity, or the full rule of law may be compromised. One way that they stay agile is by developing ongoing relationships with persons in the community that they can trust. For example, the charity Feed My Starving Children distributes food to children in poor regions as well as to regions recovering from natural disasters. It develops personal relationships with local charities that handle the final distribution of food to those people who need it most.

- For hospitals (considered a service industry), cost cutting has ruled the day since the 2008 recession, but visibility and quality are increasing in emphasis. Supply chain costs are a significant expense for hospitals. To manage these costs, hospitals are not only automating ordering but also validating that actual prices match contract prices. They are investing in keeping databases clean and up to date. They use unique device identifiers (UDI), required in the U.S. since 2014, to improve tracking and billing accuracy. From a quality perspective, administrators are looking at best outcomes over lowest cost for devices, which often shortens hospital stays and thus reduces total costs.
- Today's retailers are under tremendous pressure to redesign their supply chains to compete against online retailers like Amazon, who is putting huge cost pressure on retailers with its world-class supply chain. For example, Amazon has so many distribution centers that most orders are shipped within just one shipping zone, while most multichannel retailers have to ship through more zones at a higher cost. From an inbound freight perspective, Amazon picks up most supplier items itself using its own transportation network, while most multichannel retailers pick up less than half of items themselves. From an inventory perspective, Amazon's distribution centers (DCs) keep the top-selling items in every DC and unevenly distribute the rest to reduce inventory holding periods; this, plus integrated track and trace, significantly reduces inventory holding costs. Most multichannel retailers have DCs designed for cross-docking, which works well for retail efficiency but not for online order fulfillment.

When redesigning their organization's supply chain strategy, retailers need to think big and not only close the gaps that keep their supply chains from being less efficient than an online-only retailer but also become an effective multichannel option that is quickly responsive to the changing marketplace. For example, a retailer can use online sales to test new products and move only top sellers to retail spaces. In another example, some retailers are using their stores as distribution centers and are using store inventory to fulfill online orders.

Supply chain complexity

Exhibit 1-4 and Exhibit 1-5 earlier in this topic hinted at the complexity of multitiered supply chains.

Even the flows in our earlier street vendor example aren't as simple as might be supposed. The "products" that move through the supply chain could include materials, supplies, and the components used in the production of the menu items. Information flows may be fairly rudimentary: orders submitted by end users (consumers) of the product, by the distributor (the person on the street with the cart) to the manufacturer (the person who assembles the ingredients), and by the manufacturer to the supplier (the source of the food). There will be recipes and shopping lists, discussions of potential demand, perhaps records of last year's results. The flows of cash may be based upon cash register or credit card receipts.

Cash travels in several separate flows from the manufacturer to suppliers of products and services and, of course, to any lenders or investors for debt or dividend payments. There are also logistics concerns: transportation from one entity to the other—perhaps drawing upon the private fleet of a car or two—as well as warehousing decisions. And, finally, the reverse supply chain exists to return any unacceptable menu items, to recycle the vegetable waste into a composter, to reuse utensils and other supplies after sterile cleansing, and to recycle.

Many global businesses began in someone's home office, garage, or basement with the glimmering of an idea for, let us say, a computer operating system or a new idea for consumer-to-consumer e-commerce. Perhaps the food vendor comes up with a new twist on the old recipe for crepes; a customer is impressed and asks if the vendor can make 50 crepes for a lunch-time birthday celebration; someone at the birthday lunch owns a neighborhood restaurant...and before long the vendor has rented space in a small commercial kitchen facility to supply special made-to-order crepes. It's surprising how many challenges and opportunities can be anticipated and can be seen most easily in a very simple model.

Topic 2: Supply Chain Maturity

An organization's supply chain can have many forms. It can be a simple chain with a single strand, a complex network, or any structure between those two extremes. No matter whether it is a product or service chain, or what types of entities are involved, companies require their supply chain to guarantee a steady flow of supply while at the same time striving to reduce costs. They can improve operating efficiency by employing the right supply chain structure.

Stages of supply chain management evolution

The advances made over the past few decades in supply chain management are generally reflected in each supply chain's development. Experts in the field agree that there are typically between four and five stages in this development. We'll use a four-stage model of supply chain management evolution:

- Stage 1—multiple dysfunction
- Stage 2—semifunctional enterprise
- Stage 3—integrated enterprise
- Stage 4—extended enterprise

These stages are somewhat of a history lesson, since many organizations made these leaps over time as computers and cultures progressed. However, an organization in a particular industry may have been sheltered from some of these changes and may be less advanced than another. Similarly, other organizations may be more cutting-edge. Finally, an organization might believe it is in the highest stage but could actually have slipped down a notch through complacency. Some enterprises are likely to exhibit behaviors from two or more phases of maturity as this is an evolution, not a specific end state.

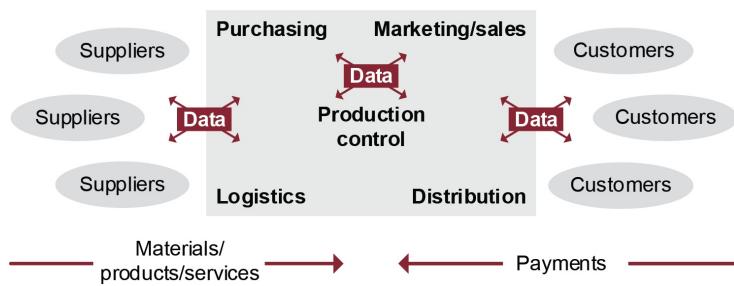
Early in the evolution of the supply chain, many organizations operated in a stable chain with predictable supply and demand. In a stable supply chain, costs are low due to predictable demand and minimal need for changes. Production runs can be long, and few line changes will be needed. This is the model that used to hold true for many industries, especially those that were regional and had only regional competitors, but as globalization and technology have connected the world, fewer and fewer industries have this level of stability. Since most industries are no longer predictable, most immature supply chains begin in Stage 1, as described below.

Whether the supply chain ownership strategy rests on vertical integration, lateral integration, or a hybrid (like keiretsu), the relative sophistication with which the chain is managed develops along the continuum that we have divided into these stages.

Stage 1: multiple dysfunction

It's possible for the nucleus company in a lateral supply chain to lack any disciplined management for both its internal and external chains; it may lack clear internal definitions and goals and have no external links other than transactional ones. Exhibit 1-7 illustrates the lack of coordinated flows of information or solid relationships among potential partners.

*Exhibit 1-7:
Multiple
Dysfunction*



This is a **reactive** supply chain:

- It fulfills demand but without much concern as to costs.
- It is perceived as a cost center.
- It needs minimal competitive or connectivity technologies and capital assets to respond to demand.

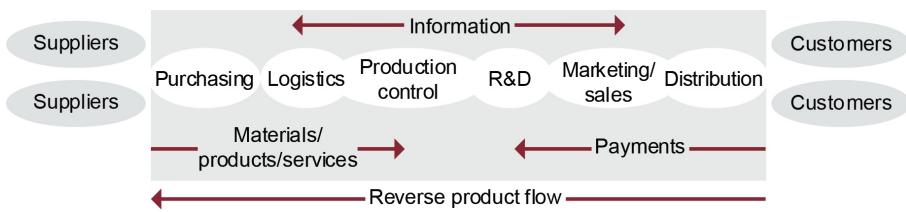
In the dysfunctional organization, this is what tends to happen:

- Internal activities tend to be undertaken impulsively rather than according to plan.
- Management provides only the most general sense of mission, communicated perhaps by pep talks at best or threats at worst.
- Forecasting tends to be mostly guesswork, often inflated by unwarranted marketing optimism.
- Products are designed without advice from other areas that could provide guidance, such as manufacturing or marketing.
- Warehouses are sited near each market, stocked with an overabundance of inventory in anticipation of a big sale, and staffed with manual laborers who have little training.
- Trucks or trains are unloaded when they arrive and loaded when an order comes in, without much advance warning in either case.
- There may be payment flows (but collection may be poorly executed) as well as material flows, but the information exchange tends to be tied mostly to giving orders internally, accepting bids, and sending invoices.
- Material requirements planning (MRP) takes place at a basic level, involving a bill of material, a master schedule, and current on-hand/on-order data.

Stage 2: semifunctional enterprise

Exhibit 1-8 provides an illustration of the semifunctional enterprise. Information flow has been improved and functional areas have been defined—but they tend to perform their functions one after the other without collaborating on the most effective ways of creating value. At this stage, there are no partnerships with customers and suppliers.

Exhibit 1-8:
*Semifunctional
Enterprise*



This is a **reactive efficient** supply chain:

- It supports competitive positioning by serving as an efficient, low-cost, and integrated unit.
- It focuses efficiency and cost management on the total delivered cost of finished goods.
- It places greater importance on connectivity technology and new equipment to automate functions to reduce labor costs and improve capacity and throughput.

In this second stage of supply chain evolution, an individual company undertakes initiatives to improve effectiveness, efficiency, and quality in specific functional areas. Here are some examples:

- The largely manual operations in warehouses may be augmented by the addition of basic materials-handling equipment.
- Inventory management may find ways to reduce levels of inventory within the company's own facilities.
- Procurement might take advantage of new purchasing strategies to obtain supplies and services at the lowest possible prices.
- The traffic department may reduce transportation costs by strategic selection of carriers and routes.
- Some departments may institute more effective hard skills training and adopt strategies for making jobs more challenging.
- Marketing may develop more reliable research and forecasting techniques.
- Manufacturing resource planning (MRP II) software may be in place, and the company may have cross-functional integration of planning processes.

While some or all functions engage in initiatives designed to increase efficiency within their departmental walls, there is little or no overlap in decision making from one department to another. When the nucleus company concentrates only on improvements within its separate departments, it may find its efforts wasted through lack of communication. For example, market researchers and well-trained sales representatives may uncover market opportunities among current and potential customers without being provided an opportunity to share this information in a structured collaboration with product designers. And this lack of collaboration may play out repeatedly among the departments. In this stage some functions may be automated—MRP software, for instance, may put the bill of material in the computer to streamline workflow. But new software in one department may be incompatible with current software in other areas.

Stage 3: integrated enterprise

In the third stage of supply chain evolution, the individual company begins to focus on companywide business processes rather than individual compartmentalized functions. Historically, this shift in supply chain strategy is associated with the late 1980s and early 1990s—the same time that personal computers were becoming more powerful, reliable, and affordable.

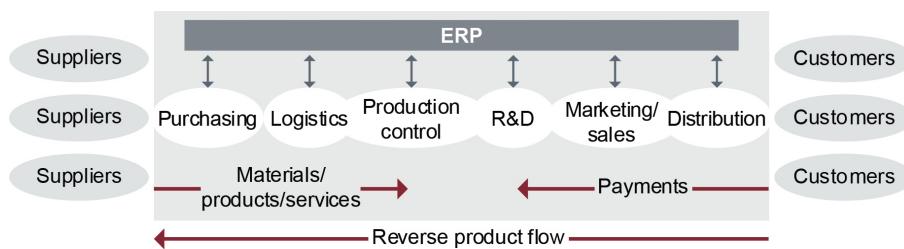
There are a few key milestones that mark this phase: introduction of manufacturing and enterprise-wide software, increased cross-functional communication and training, centrally located and easily accessible databases and files, and periodic sales and operations planning meetings attended by representatives for all departments involved.

This is a **proactive efficient** supply chain:

- It recommends new raw materials or product designs to reduce complexity and costs.
- It instigates changes to product designs for greater efficiencies.
- It invests in integrated information systems to facilitate sharing of information across functions.

Exhibit 1-9 provides a visual representation of a linked internal supply chain with collaboration between functions and sharing of information through companywide enterprise resources planning software. ERP is discussed in a later section.

*Exhibit 1-9:
Integrated Enterprise*



This stage is markedly different from the previous one because of the following:

- The focus on business processes is facilitated with the increased availability of email, file transfers, powerful databases, and enterprisewide software applications. Cross-functional cooperation becomes much faster and easier and takes place almost instantaneously across functions, time zones, and international boundaries.
- A variety of initiatives reduce the time it takes to get an order from a supplier, create the product, and deliver it to the customer, including MRP II and ERP:
 - MRP has been upgraded to MRP II, a breakthrough development that allows cross-functional communication between manufacturing and finance.
 - ERP extends that process by adding modules for each functional area until the most advanced versions tie together entire companies. Further advances have reached through the corporate wall to tie supply chain partners together.
- Product design in some companies is now a team effort in which production engineers and other stakeholders, such as marketing and purchasing, collaborate with design engineers to “design for marketing,” “design for logistics,” or “design for the environment.” This approach results in products that are on target for customer desires and are ready to be manufactured without making costly modifications in processes, equipment, or staffing.
- There are improvements in customer service due to astute segmentation of markets and more efficient

replenishment policies suited to each segment.

- Inventory is treated more strategically as Just-in-Time procedures, more accurate demand planning, and improved logistics work together to make fulfillment more efficient and reliable.
- Warehousing and transportation decisions are carried out in tandem to achieve the optimal balance of cost-effectiveness and customer service.
- Warehouse management benefits from more advanced equipment and automation.

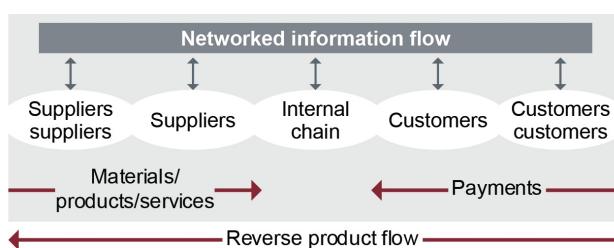
At this point, the nucleus company may begin to take a step toward integration with the external members of the supply chain by contracting with a logistics supplier, such as United Parcel Service (UPS), to “insource” by using its expertise to help optimize logistics decisions.

Stage 4: extended enterprise

The hallmark of this stage is the decision to extend at least one business process beyond the boundary of the individual corporation. When the nucleus company decides to collaborate on planning, design, replenishment, logistics, or another business process with one of its suppliers or customers, the barrier to developing the extended enterprise from end to end of the supply chain has been overcome. The company integrates its internal network with the internal networks of selected supply chain partners to improve efficiency, product/service quality, or both. The starting point is generally one inside/outside partnership that points the way toward the completely networked enterprise.

Exhibit 1-10 shows how the supply chain has changed.

*Exhibit 1-
10:
Extended
Enterprise*



This is a **strategic driver** supply chain:

- Demand generation and fulfillment are fully integrated.
- The supply chain contributes to development of the organization's overall strategy.
- Forecasting, planning, and replenishment are fully integrated and visible.
- Technological improvements, knowledge, and real-time information are shared with chain partners.

What is unique to this stage is the following:

- There is an initial exploratory collaboration between a channel master and one or several partners in the supply chain—often a manufacturer and one component supplier or a retailer and one supplier of finished goods. It may involve only one component or product; the famous collaboration between

Procter & Gamble and Walmart began with diapers. If this first collaboration succeeds, it can lead to a more fully networked relationship between the first two partners—more products might be involved, there might be more complete sharing of information across integrated electronic networks and more formal team building and planning across corporate boundaries, and so on. And that relationship can become the model for other partnerships and, eventually, for multicorporate collaborations that stretch from retailer through manufacturer into one or more tiers of suppliers.

- Technology enables the extended enterprise to reach farther, to add new partners, to move faster in response to market changes, and to operate with broader scope than in Stage 3. With MRP II merged with other functional applications and transformed into ERP, enterprisewide planning software is able to link the entire internal supply chain together on one platform.
- The networked enterprise is built on intranets, extranets, peer-to-peer networks, the internet, or a combination of those platforms. Partners begin to synchronize their ERP systems across corporate boundaries so they can share data as necessary for their efficient collaboration. A retailer may, for example, send information from the point-of-sale to suppliers each time a customer purchases an item to trigger production of a replacement. For example, Dell Computer is able to fill orders taken on the internet without keeping its own inventory of machines because customers' specifications are sent immediately through to component suppliers so the computer can be assembled to order.
- Cross-functional approaches are implemented with certain processes, such as CPFR (collaborative planning, forecasting, and replenishment). In place of traditional "silo" production planning by sales, marketing, and production, Stage 4 companies institute periodic sales and operations planning meetings in which representatives of sales and marketing, production (or operations), and other functions meet to coordinate demand planning and production scheduling.
- In Stage 4, there are advances in e-commerce such as interactive sites where customers can order products and services, track their shipment, and communicate with customer service immediately upon their arrival. Behind the scenes of such business-to-consumer e-commerce, there is also increasing business-to-business e-commerce taking place on wired and wireless networks. In the global arena, competition no longer takes place only among individual companies; whole supply chains are now battling one another for customers, for workers, and for capital in multiple countries across the globe. Cooperation among companies is integral to competition among supply chains.

The goal for a supply chain strategy is to ensure that the organization's supply chain is at Stage 4 and to assess if there are gaps that are keeping it from fully realizing this level of connectivity and visibility. Resolving misalignments or gaps is discussed below.

Later in these materials you will learn more about evolved and sophisticated supply chains like those in Stages 3 and 4—those having network partners with highly integrated and synchronized connectivity that focus more on value than on cost.

Chapter 2: Inputs to Supply Chain Strategy

This chapter is designed to

- Describe the relationship between the business strategy, the organizational strategy, and the supply chain strategy
- Define four types of organizational strategies and how they are used
- Explain how strategic decisions are made concerning customers and markets, technology, key processes, and sourcing
- Discuss the importance of scanning the external environment for competitor capabilities, market conditions, and global perspectives.

Topic 1: Internal Inputs

A **business model** is an organization's plan to generate revenue and turn a profit based on its operations. It shows how the organization will differentiate itself from the competition and how it will function, including the expenses it expects to incur and how its components will work together. A business model is the organization's modus operandi, or way of doing things. A business model consists of a

- Business strategy
- Organizational strategy
- Business plan
- Value proposition
- Set of core capabilities
- Cost structure
- Revenue model.

Each of these elements is discussed next.

Business strategy

Typically, a business strategy will outline how to grow the business, how to distinguish the business from the competition and outperform them, how to achieve superior levels of financial and market performance, and how to create or maintain a sustainable competitive edge.

The definition provided previously describes business strategies as including least cost, differentiation, and focus. Least cost relates to a lower cost than the competition for an otherwise equivalent product or service. Differentiation relates to a product or service with more features, options, or models than the competition. Focus relates to whether the product or service is designed for a broad audience or a well-defined market segment or segments. There are many ways that these generic strategies can be combined or made into hybrids, for example:

- **Low cost**—Focuses on delivering no-frills basics with low prices that are hard to match; cost is the basis for competition.
- **Best cost**—Focuses on delivering the best value at a relatively low price; both cost and quality are the bases for competition.
- **Broad differentiation**—Creates product/service attributes that appeal to many buyers looking for variety of goods; customer experience and/or quality are often the basis for competitive differentiation.

- **Focused differentiation**—Develops unique strategies for targeted niche markets to meet unique buyer needs; niche marketing and innovation are important examples of this type of competitive basis.
- **Focused low cost**—Designed to meet well-defined (niche market) buyer needs at a low cost; responsiveness can be the basis for competition.

Competitive advantages mirror the strategies used to create them: A competitive advantage exists when an organization is able to provide the same benefits from a product or service at a lower cost than a competitor (low-cost advantage), deliver benefits that exceed those of a competitor's product or service (differentiation advantage), or create a product or service that is better suited to a given customer segment than the competition can offer (focus advantage). The result of this competitive advantage is superior value creation for the organization and its customers. If this advantage is successfully implemented and marketed, it should result in improved profits and market share.

To see how low-cost-, differentiation-, and focus-based competitive advantages could be interpreted in an organization and its supply chain, we will explore each of these strategies in more detail next.

Low-cost advantage strategies

Strategies consistent with a low-cost approach to competition include a variety of methods to reduce cost in all areas of the supply chain, including resource extraction, transportation, warehousing, and location and design of retail facilities. A powerful nucleus company with a low-price strategy and a large market share can exert great leverage on its suppliers. Such a company may be able to require suppliers to cut facility costs, relocate, adopt lean manufacturing (an approach that focuses on waste reduction and quality), change employment practices, and so forth.

A low-cost strategy is adopted in supply chain strategy as high operational efficiency, standardized products, and tight supplier inventory control. Supplier quality also needs to be high, or rework and returns will cut deeply into the thin profit margins of this model. Supply chain metrics need to measure efficiency from many perspectives, including asset utilization, inventory turnover, and various direct, indirect, and total cost measures.

A low-cost strategy should not be confused with target cost. **Target costing** is defined in the *APICS Dictionary*, 16th edition, as

the process of designing a product to meet a specific cost objective. Target costing involves setting the planned selling price, subtracting the desired profit as well as marketing and distribution costs, thus leaving the required manufacturing or target cost.

In many locales, this strategy has resulted in the opening of numerous “dollar stores,” where the majority of the products are only one dollar and the selection is huge.

A variant on a low-cost strategy for multinational corporations is a **global strategy**, defined in the *APICS Dictionary*, 16th edition, as

a strategy that focuses on improving worldwide performance through the sales and marketing of common goods and services with minimum product variation by country. Its competitive advantage grows through selecting the best locations for operations in other countries.

In addition to selecting low-cost countries for operations, this strategy benefits from economies of scale by selling products with little variation in all markets. The items themselves may be cheap, expensive, or a varying mix of products, but they can have a lower cost than the competition can offer because of these competitive advantages.

Note that providing a product or service at the lowest price is generally not compatible with either the differentiation or focus (niche marketing) strategy. The lower profit margins provided by this approach are more consistent with mass marketing. However, even low-cost products have to meet some quality standards to remain competitive. Also, price competition can exist within a niche or differentiated market. One luxury automobile may undercut another in price, for example, if it maintains a level of quality and a sterling reputation.

Product or service differentiation advantage strategies

Determining how to differentiate a product or service begins with a competitive analysis of other companies in the market to see what they have to offer. According to the *APICS Dictionary*, 16th edition, **competitive analysis** is “an analysis of a competitor that includes its strategies, capabilities, prices, and costs.”

Once a company has analyzed the offerings of competitors, it may differentiate its products and services in a number of ways. This is known as **product differentiation**, “a strategy of making a product distinct from the competition on a nonprice basis such as availability, durability, quality, or reliability” (*APICS Dictionary*, 16th edition).

The following are some types of differentiation:

- High quality—durability, appearance, performance, type of materials, and so on (Quality is often an order “qualifier,” or an element necessary for a customer to even consider the purchase of a particular product.)
- Diversity of the product line, offering customers many options (The opposite of this approach was Henry Ford’s alleged claim that people could have his cars in any color they wanted as long as they wanted black.)
- Greater reliability (which could be considered a type of quality)
- Special features not available from competing products or services

Taking quality as a differentiation strategy example, the idea is to gain a reputation for reliability and consistency, which requires solid investment in product development and the processes of source, make (especially quality assurance), and return. Quality can be a differentiator for perishable or fragile goods. In this case, transportation and storage are key areas to focus on in the supply chain strategy. For example, Tropicana has not only invested in cutting-edge refrigerated trucks but has also developed a system to ensure that oranges are harvested at peak ripeness.

Supply chain strategies appropriate for product differentiation include

- Modular design combined with postponement. **Postponement** is defined in the *APICS Dictionary*, 16th edition, as “a product design or supply chain strategy that deliberately delays final differentiation...until the latest possible time in the process.” It is covered in more detail later. Modular design with postponement allows last-minute customization to meet specific consumer demands.

- A base model with numerous options to reduce the risk of obsolescence (e.g., the same base could be used with upgraded subcomponents) while providing a large effective inventory (many configurations) with a small actual inventory.
- Collaboration with suppliers to develop innovative designs, numerous options appealing to different customer tastes, artistic design, and so on.
- Global track and trace technology to reduce the risk of counterfeit items or subcomponents.

Another way to differentiate a product or service is to provide a superior customer experience. When customer experience is the organization's primary competitive basis, the organization develops a thorough understanding of customer preferences to provide products and services that are just right and are available where and when the customer needs them. This could be as simple as a convenience store that is open at all times. When customized services are offered, the organization's supply chain needs to be sophisticated enough to measure the cost of offering these services to ensure that they remain profitable. From an inventory and logistics perspective, differentiation requires getting goods and services to customers based on their preferences while avoiding the need for expedited production or delivery.

For example, Zappos.com is a shoe, jewelry, and clothing website that places customer service above all other priorities. Their customer service specialists are trained to take as much time as needed to help each customer, even calling them back after tracking down a difficult-to-find pair of shoes, rather than the standard call center philosophy of minimizing customer call time (and thus cost). Since they do not offer above-average pay to call center employees, to ensure that they get only employees who want to provide this high level of personalized service, they offer new employees a one-time cash offer to quit after the first week. This provides an incentive for less-committed employees to self-select out.

In the business-to-business arena, customer experience may mean keeping the customer's operations up and running without interruption. For example, Sandwick Mining provides rock drilling equipment and parts for mining operations. In this industry, keeping the customer's equipment going over all work shifts, day in and day out, is more important than the price of the equipment and spare parts. Providing this reliable customer experience is what the organization differentiates itself on.

Focus advantage strategies

Ways to create a focus advantage include

- Niche marketing
- Responsiveness
- Innovation.

Focus: niche marketing (versus mass marketing)

Companies can choose to develop products and services for a mass market or for a focused slice of a larger market—a niche market.

As defined in the *APICS Dictionary*, 16th edition, **mass marketing** is “the strategy of sending the same message to all potential customers.” Mass marketing’s advantage is the ability to create a simple message and repeat it numerous times using mass media until the message enters the consciousness of consumers.

Mass marketing is appropriate for products and services that have broad appeal across many market segments, either because they are staples that everyone needs or because marketing can be used to create an apparent general need or desire. (Bottled water is an example of a product that marketing has developed into an apparent need.) Mass marketing is not just for standardized products. For example, it can be used to sell a customizable product such as a sandwich restaurant that allows customers to specify toppings. The point of mass marketing is to have a single message that can be broadly disseminated, not necessarily to restrict customers to a one-size-fits-all product or service.

Niche marketing is used to design messages to be especially appealing to one or more market segments. Niche marketing can also use less costly delivery channels because messages can be delivered over just the media the target segments (also known as channels) are likely to use. Internet advertising can even tailor marketing messages to a segment of just one person based on that person's browsing or purchasing history.

Some examples of niche market approaches include

- Catering to high-net-worth customers with products such as luxury automobiles, yachts, large homes, or specialized services such as estate planning, personal training, or expensive cruises
- Designing for a limited age group, such as children or senior citizens with special needs, instead of serving a broader population
- Providing products or services for residents of a particular geographic area, such as growing vegetables for a neighborhood market rather than for packaging and shipping around the nation or world.

Niche marketing shares some characteristics with product/service differentiation. In both cases, the product or service provided to customers has special features. Differentiation by quality, for example, can be the same thing as catering to high-net-worth customers. (Low-net-worth customers, or value shoppers, can also be a niche market.) Some supply chain strategies will work for both approaches. Collaboration to achieve distinctive design is one example. Depending upon the niche, sourcing may focus more on finding special expertise or high-quality materials than on low-cost labor or materials.

An international variant on niche marketing is a **multicountry strategy**. The *APICS Dictionary*, 16th edition, defines this as "a strategy in which each country market is self-contained. Customers have unique product expectations that are addressed by local production capabilities."

Focus: responsiveness

Perhaps the most obvious example of responsiveness is the fast-food industry that grew up in the last half of the 20th century, led by McDonald's. Diners at fine restaurants will happily wait half an hour for their specially cooked steak, but employees on short lunch breaks become impatient with even a few minutes in line as their sandwiches are prepared. In the early days of the Toyota Prius automobile—a highly differentiated car—buyers were known to wait for months for a new vehicle. (The same phenomenon occurred when the Volkswagen "Beetle" first came to the United States, where it was both highly differentiated and a low-cost option.) But businesspeople or diplomats on assignment expect a rental car or limousine to be ready immediately when they arrive at the airport. Manufacturers of clothing prosper or go bankrupt by their ability to bring the latest seasonal designs to market rapidly. Perishable products, such as raw food items, must be delivered rapidly, unlike preserved foods. Services may also compete on the basis of speed by cutting time

spent waiting on the phone, standing in line, or processing paperwork.

Supply chains designed for responsiveness may rely on substantial supplies of safety stock to avoid outages. (Overstocked seasonal items typically go on sale at the end of the season.) Supply chains may also have multiple warehouses to place products nearer to users. Another way to develop responsiveness is to invest in supply chain agility, which refers to the ability of sourcing and manufacturing to ramp up or down in production volume quickly without undue costs or hardship. Setting up an agile supply chain can have a large initial cost, but over time it might be more cost-effective than relying on large safety stocks.

Focus: innovation

A focus on innovation means ensuring that the organization's products and services remain so cutting-edge that they become must-have items for the target market. Apple is a clear example of this competitive model. To succeed at innovation, an organization needs to not only invest heavily in research and development but also address changing customer desires related to functionality and style.

Supply chains enable an innovation strategy by focusing on time-to-market and time-to-volume. Time-to-market creates the differentiation between the organization and its competitors. Products that get to market sooner will have a longer amount of time to capture market share before the competition copies the innovation. Time-to-volume is critical because demand will peak in the early period of the release and then drop off relatively quickly. Failure to satisfy demand during the early period will severely impact profits. A supply chain that is fully integrated with product design will provide designers with materials and subcomponents that can be quickly and efficiently sourced and produced. This requires close integration of information flows, processes, and physical plants and assets.

Organizations also need to establish defined quality levels for all suppliers so that the right parts arrive on time with no delay. Since compressing design and innovation increases the risk of quality issues, this places more of the quality burden on suppliers, which may result in delays if they come up short. For example, on the verge of its initial release in April 2015, the Apple Watch had a supply chain issue with a defective subcomponent. A part that made a gentle tapping sensation on the wrist was found to be defective. Since quality control found this issue before the watches were shipped to customers, rework but not recall was needed, and one of the two suppliers of this subcomponent needed to be abandoned. The remaining supplier needed extra time to ramp up to the increased demand. This created a bottleneck on time-to-volume at a critical time for the innovative technology.

Choosing a business strategy

While some companies may focus primarily on one competitive strategy, others may pursue a mix of strategies. Note, however, that making one strategy the priority may make other strategies difficult to achieve. For example, providing high quality at the lowest price is a challenge. But not all the strategies are mutually exclusive. As noted above, product differentiation and niche marketing fit well together. Either responsiveness or low cost may be a key competitive factor that differentiates an organization from its market rivals.

That being said, trying to be all things can dilute the competitive advantage organizations get from specialization. While a company that focuses on innovation needs to keep costs competitive and a cost

strategy company still needs to pay attention to quality, these additional considerations aren't the factors that drive strategic decisions. For example, Spirit Airlines has decided to be the "dollar store" of airlines. Since it is an airline, it obviously needs safe airplanes, but strategic decisions are based on the budget travel model. The number of seats per plane needs to be maximized even if this impacts customer comfort, so their seats don't recline. They also charge for water and all other items and put advertisements all over the plane. Customer complaints are high with this airline, but they get many repeat customers—even many complaining customers—because the price of the flight is the driving factor behind many actual purchase decisions.

Once an organization has decided on a business strategy, it uses these choices to drive the organizational strategy and eventually the supply chain strategy.

Organizational strategy

Recall from the definition provided above that "the strategy of an enterprise identifies how the organization will function in its environment." Where do you start when building an organization's strategy? The best place to start is to envision what the future should look like, or to begin with the end in mind. The end result is the goals of organizational strategy.

Goals of organizational strategy

Whatever strategy the corporation adopts to satisfy customers, grow, compete, organize itself, and make money, the supply chain has to operate in a manner that furthers those goals. To give a simple example, if customers are clamoring for deeply discounted prices on durable, high-volume goods with stable demand, a supply chain strategy that focuses on low-cost sourcing and/or capital expenditure with justified ROI (return on investment) would be on target to accomplish that goal. In the case of equipment investments, ROI would need to come in the form of lower labor costs, greater throughput, or increased economies of scale.

Horizontal supply chains will contain a number of independent organizations, each with its own goals, processes, operations, technology, and strategy. So, when we refer to the necessity of aligning supply chain strategy with organizational strategy, we are referring to the strategies of a channel master or nucleus firm. Traditionally, that's the manufacturer of a product—the company that sits right at the center of the supply chain (or network), with suppliers in tiers on one side and customers on the other.

However, if a supply chain has a dominant company with a dominating strategy (one that is dictating its requirements to others), for example, a large retailer, then supplier and manufacturer strategies and goals must align with that retailer's organizational and supply chain strategies. The suppliers of suppliers also have strategies to be brought into alignment. Finally, the strategies, once aligned, have to do two things: serve the end customers' needs and be profitable for the supply chain as a whole and each company individually.

The following looks at four types of organizational strategy in detail: customer focus and alignment, the forecast-driven enterprise, the demand-driven enterprise, and product-type-driven supply chains.

Strategy: customer focus and alignment

Organizations with a customer focus and alignment prioritize what's good for the customer—not what's good for the nucleus company or even what seems to be good for the supply chain itself. The matching supply chain strategy therefore needs to be focused on giving the final customer the right product at the right time and place for the right price. It isn't necessarily about the most advanced product or service, nor is it always

about the lowest price, the fastest time, or the most convenient place. It's about the balance of quality, price, and availability (timing and place) that's just right for the customer.

How does one determine what is the right amount of each of these factors? There isn't a simple formula that will help the organization with this decision. But there are some basic premises that will help supply chain managers get started in determining the appropriate balance to enable this strategy:

- Serving the end-user customer is the primary driver of supply chain decisions.
- Organizations in the supply chain have to make a profit and stay in business to serve the customer.

Functional teams in the organization will provide their input and research on the optimal balance for the supply chain to meet customer needs. Design engineers—or, better yet, design teams from across the network—design products that are right for the end customer and can be sold profitably. Market research looks for the true, and not always obvious, needs in potential consumers that the supply chain can be engineered to satisfy profitably. Logistics strategy begins with data about customer demands for availability—of materials, components, service, or finished products, depending upon the customer—and then it looks for ways to move products in a cost-effective way with acceptable risk.

Decisions are not just about product features or price or speedy delivery. They are about the right features at the right price on the right schedule. Back in 1981, Microsoft's DOS was not a great operating system; it was just the right operating system for the time and the market.

The term "customer" can be a complex concept in relation to supply chains because there may be multiple customers with different stakes in the process. When we talk about customer focus, we mean the end user, the consumer of the product. But usually only the retailer actually sees the end user and has a direct relationship with that person or entity. Everyone else in the supply chain has a more immediate customer just downstream before one gets to this ultimate customer. If the supply chain is completely aligned in its focus on the end customer, then, at least in theory, serving the customer just to an organization's downstream side would automatically serve the end user and also be in the supplying organization's best interest as well as the interest of investors.

Within each supply chain partner there are internal "customers" whose needs also must be aligned with corporate and supply chain strategies. Each manager must understand his or her role in making the supply chain profitable, and staff, too, must be rewarded, motivated, and trained in alignment with the needs of the supply chain's end customer.

Consider sustainable supply chain management, which is basically a supply chain that works to maximize the positive long-term social and environmental impact of its actions while remaining profitable. Successfully managing for sustainability requires a strategic mindset, involving numerous personnel and financial resources and a commitment from suppliers from the first to lower tiers of the supply chain as well as consumers further up the supply chain. Departments must cooperate with other departments in their organization (e.g., purchasing and environmental or design departments) and with their counterparts at suppliers. This type of collaboration between supply chain partners necessitates breaking down cultural barriers and building a culture of trust to ensure that the focus is on end-to-end supply chain activities and not just discrete supply chain processes.

Creating and managing a sustainable supply chain requires an organization to be informed, exercise leadership, and cooperate with all supply chain partners in achieving positive results on the triple bottom line, which is a sustainability measurement system that adds environmental and social goals and metrics to traditional economic goals and metrics to produce profitable sustainability. The triple bottom line is discussed in a later section on sustainability.

Strategy: forecast-driven enterprise

A second organizational strategy is the forecast-driven enterprise. Simply put, this strategy is one in which the nucleus company, usually the manufacturer, utilizes a forecast, an estimate of future demand, as the basis of its organizational strategy.

When a supply chain works in response to forecasts, it's called a "push" chain or **push system**, and it entails the following (as described in the *APICS Dictionary*, 16th edition):

- 1) In production, the production of items at required times based on a given schedule planned in advance.
- 2) In material control, the issuing of material according to a given schedule or issuing material to a job order at its start time.
- 3) In distribution, a system for replenishing field warehouse inventories where replenishment decision making is centralized, usually at the manufacturing site or central supply facility.

Everything in a push system is pushed downstream from one point to the next according to schedules based on the forecasts. The supplier delivers components in the amounts determined by the schedule to inventory, where they await use in manufacturing. The plant turns them into finished products and pushes the products to the distribution center or the retailer, where they await an order from downstream.

Here is the complicating factor: It is difficult to know what customer requirements will be from day to day, month to month, quarter to quarter, and so on. If a manufacturer were guaranteed that its customers were going to need 1,000 SKUs (stock keeping units) every Wednesday afternoon, then getting those products to customers at the right time and place would be a matter of simple calculation based upon lead times for production and delivery. In turn, the manufacturer would look at the bill of material, determine the lead time for each item listed in the bill, and submit schedules to its suppliers.

Unfortunately, it's difficult to predict even the most stable demand—say, for a product like diapers. There is some variability in demand for diapers, even though they aren't subject to seasonal style changes or rapid peaks and valleys in response to outside influences affecting ability to pay. That's why Procter & Gamble cooperates with Walmart to plan for demand and replenishment of diapers.

In this retail example, forecasting along the supply chain works like this:

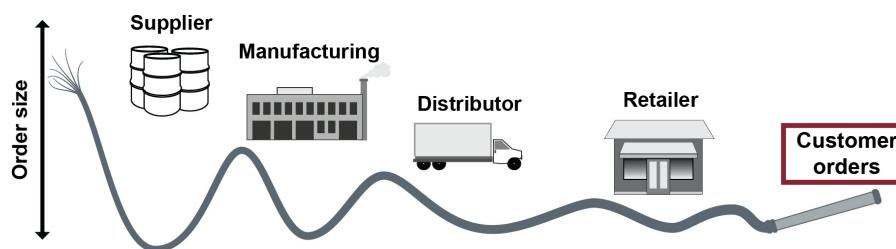
- The retailer forecasts demand from parents who purchase diapers.
- The wholesaler forecasts demand from all its retailers.
- The manufacturer forecasts demand from the wholesale distributors.
- The component suppliers forecast demand from manufacturers.
- The raw materials suppliers forecast demand from the component manufacturers.

How effective is this strategy? You don't want to be placing large bets on the accuracy of all those forecasts. Here's what typically happens:

- Parents vary their diaper-buying patterns in fairly small increments due to factors nobody fully understands. They may go to different stores for a change, shop on Tuesday instead of Wednesday, or buy two or three weeks' worth at one time because the diapers are on sale. So, actual demand never quite meets the forecast.
- Meanwhile the retailer had already ordered enough to allow a little extra safety stock to put in its storeroom. Or maybe the retailer runs a promotion that is not communicated to the distributor, thus resulting in needing a larger order than was previously forecasted. These fluctuations impact forecasting for the distributor.
- The wholesale distributor had forecasted demand based on past orders from its retailers. But now those demand patterns have a wider variability than the demand pattern at the retailer's checkout counters due to that safety stock the retailer held on to. Sometimes the safety stock accumulates because demand is less than the forecast, and this means that the retailer's next order is for less than its forecast—or perhaps it doesn't have to order at the usual time at all, because it has a glut of diapers—which it probably sells off in a promotion. The upshot of all this is that the small variations in end-user demand are magnified at the distributor.
- Up the supply chain, the manufacturer of those diapers looks at the demand pattern from the distributor and makes its own forecasts, which show an even wider swing in variability.
- And this variability goes up the supply chain with ever-wider swings.

This pattern of variability, called the **bullwhip effect**, is shown in Exhibit 1-11. It affects all manner of supply chains that are based on serial forecasting by each independent division or company that touches the product as it travels from raw material to finished retail item.

*Exhibit
1-11:
Bullwhip
Effect*



Strategy: demand-driven enterprise

The bullwhip effect is driven by demand forecasts; the solution is to replace the forecasts with actual demand information. This isn't necessarily a simple matter either, but supply chain professionals have evolved techniques for letting actual orders (not forecasts) drive production and distribution.

The demand-driven supply chain, also known as a **pull system**, entails the following, as defined in the *APICS Dictionary*, 16th edition:

- 1) In production, the production of items only as demanded for use or to replace those taken for use. 2)

In material control, the withdrawal of inventory as demanded by the using operations. Material is not issued until a signal comes from the user. 3) In distribution, a system for replenishing field warehouse inventories where replenishment decisions are made at the field warehouse itself, not at the central warehouse or plant.

In the demand-driven supply chain, supply management is focused on customer demand. Instead of manufacturers planning their operations based on factory capacity and asset utilization, the demand-driven supply model uses a customer-centric approach that allows demand to drive supply chain planning and execution—moving the “push-pull frontier,” as it’s called, back up the supply chain at least to the factory. Instead of producing to the forecast and sending finished products to inventory, the production process is based on sales information. There is, in other words, no fixed production schedule in a strictly demand-driven supply chain. Product is turned out only in response to actual orders, “on demand,” in other words. This often leads to a decrease in lead times due to the ability to better anticipate incoming orders from the retailer. (Note, however, that on the supplier side of the plant, forecasts still determine delivery of raw material. The art of forecasting remains crucial, even in a demand-driven supply chain.)

The challenge in changing from forecast-driven (push) systems to demand-driven (pull) systems is in reducing inventory without also lowering customer satisfaction. When a demand-driven system is set up and managed properly, it can actually enhance customer service while reducing costs. But stockouts are a risk.

As always with supply chains, the decision to switch to a demand-pull process trades one type of risk for another:

- In the forecast-push process, the risk is related to the build-up of inventory all along the supply chain. Not only does inventory cost money while it sits in a retail stockroom, distribution center, or preproduction storage area; it runs the risk of becoming obsolete or irrelevant for a number of reasons. In a world of rapid innovation, inventory obsolescence is a very real threat. For example, Cisco Systems, for years an exemplar of successful and innovative supply chain management, had to dispose of US\$2.25 billion worth of useless inventory when the dot-com bubble burst at the beginning of this millennium. All those season close-out sales you see in clothing and department stores are a way of clearing out the overstock. Bookstore remainder tables are a sign of inventory overhang caused by failed forecasting. Magazine distributors used to destroy huge quantities of monthly magazines when they came back from retail outlets. (Since magazines are inexpensive to produce and destroy compared to their retail price, the distributors would rather destroy ten copies than miss one sale.) Those are the results of producing to forecasts that no one trusts and purposely overstocking to be sure of meeting unexpectedly high demand.
- In the demand-pull, make-to-order model, on the other hand, the risk is that orders will begin to come in above capacity and all along the supply chain there will be expensive activity to run the plant overtime, buy more and faster transportation, or sweet-talk customers into waiting for their orders to be filled or substituting a different product. (Running short of stock is also a risk in the forecast-driven supply chain. Forecasts can be wrong in either direction. That’s why the safety stock builds up at each point where orders come in.) One technique to prepare for uncertain demand is kitting, which is preparing (making/purchasing) components in advance, grouping them together in a “kit,” and having them available to assemble or complete when an order is placed.

Gartner's annual supply chain report ("The AMR Supply Chain Top 25 for 2010") ranks the top 25 demand-driven supply chains, thereby underscoring the importance of this strategy. In fact, the companies that gain a position on this list have all applied demand-driven principles to coordinate supply, demand, and product management to better respond to market demand. If you would like additional information about this report, a link is provided in the online Resource Center.

In reality, most organizations pursue a push-pull strategy and the point where push moves to pull is the key strategic decision. Once that decision has been made, building a demand-driven enterprise can require significant changes in all supply chain processes.

The following are some major steps:

- **Provide access to real demand data along the supply chain for greater visibility of the end customer.** The first requirement is to replace the forecasts with real data. The only supply chain partner with access to these data firsthand is the retailer, and retailers in the past have been no more willing to share business data than any other company. The other partners lack "visibility"—one of the main supply chain principles promoted by APICS. They simply cannot see what's going on with the end customer. But visibility is a necessity for building a pull system, and pioneers like Walmart have led the way in that regard. With point-of-sale scanning or radio frequency identification (RFID), a retailer can alert its suppliers to customer activity instantaneously. Instead of producing to the monthly forecast, manufacturers with that kind of immediate signal from the front lines can plan one day's production runs at the end of the preceding day. They produce just enough to replace the sold items.
- **Establish trust and promote collaboration among supply chain partners.** Collaboration is implied in the sharing of information. But more is at stake than simply sharing sales information. Partners may have to invest in new technology and develop new systems to be able to use the real-time data. With orders going out without a schedule, all processes will have to be altered—warehousing (storage no longer needed), packaging, shipping, and planning will all be handled differently in the new system. In return for receiving real-time data that allow reduction of inventory, suppliers and distributors have to agree to change their processes in whatever ways may be necessary to make the new system function without disrupting customer service.
- **Increase agility of trade partners.** Because the inventory buffers will not exist or will be much reduced in this demand-driven supply chain, the trade partners need to develop agility—the ability to respond to the variability in the flow of orders based on sales. The plant, for example, may have to undergo considerable change if it has to produce several different kinds of products under the new circumstances. When making-to-forecast, a plant can run a larger volume of each product to send to inventory; when making-to-order, the plant may have to produce several different types of products in a day. There will be no room for long changeover times between runs of different products; therefore, equipment, processes, work center layouts, staffing, or siting—or all these things—may have to change to create the capacity required to handle the new system.

Strategy: product-type-driven

The last strategy we'll cover is based on a company having more than one supply chain, depending upon the types of products that are passing along the chain and other variables. For a product with a complex bill of

material (many parts that combine into many components to make the final product), a manufacturer may be bringing in materials from many suppliers. And these materials might range from low-priced commodities to fragile or sophisticated materials that require special shipping and handling. Suppliers might range from small specialized organizations to raw materials giants larger than the manufacturer. Some are key accounts; some might be occasional buyers. The finished products may be sold through several different channels—e-commerce, printed catalogs, commercial, retail. These variables may combine in different ways, each suggesting its own type of supply chain strategy.

In “What Is the Right Supply Chain for Your Product?” Marshall L. Fisher distinguished two types of products, functional versus innovative, that require different supply chain strategies.

Functional products “are mature products that tend to have a low profit margin and a predictable demand” (*APICS Dictionary*, 16th edition). Functional products change little from year to year and have longer life cycles (perhaps more than two years), relatively low contribution margins, and little variety. Because demand for them is stable, they are fairly easy to forecast, with a margin of error of about 10 percent, very few stockouts, and no end-of-season markdowns. The appropriate supply chain for these products should emphasize predictability and low cost with performance indicators such as

- High average utilization rate in manufacturing
- Minimal inventory with high inventory turns
- Short lead time (consistent with low cost)
- Suppliers chosen for cost and quality
- Product design that strives for maximum performance and minimal cost.

However, make-to-order functional products, such as replacement parts for customized equipment, usually have long lead times (six months to a year).

Innovative products have unpredictable demand, relatively short life cycles (three months for seasonal clothing), and high contribution margins of 20 to 60 percent. They may have millions of variants in each category, an average stockout rate from 10 to 40 percent, and end-of-season markdowns in the range of 10 to 25 percent of regular price. The margin of error on forecasts for innovative products is high—40 to 100 percent—but the lead time to make them to order may be as low as one day and generally is no more than two weeks.

The supply chain for innovative products should emphasize market responsiveness rather than physical efficiency, with performance indicators such as

- Excess buffer capacity and significant safety stock of parts or finished items
- Aggressive reduction of lead times
- Suppliers chosen for agility: speed, volume and production run flexibility, and quality (rather than cost)
- Modular design that postpones differentiation as long as possible.

Innovative products, with their high margins and unpredictable demand, justify the extra expense for holding costs. (Fisher also proposes, however, that manufacturers of innovative products can look for other solutions to the problem of unpredictable demand, such as aggressively reducing lead times and producing products to order rather than for inventory.)

Here is a conundrum...What happens when a product can fall into either category? Fisher says that some products can be either innovative or functional. Automobiles fit that description, with a low-priced, no-frills car like a base model Ford Fiesta or Hyundai Accent representing the functional end of the spectrum and a Porsche representing the other end. Similarly, coffee can be functional—as anyone who has worked in an office knows, in which case it should be available quickly at a low price with perhaps cream and sugar as options. At a high-end coffee shop, on the other hand, patrons are willing to endure longer lead times and pay more money for their coffee, but they want variety in return.

The idea that the same type of product can be either functional or innovative implies that one company might have more than one supply chain (or channel). And that's the contention of Jonathan Byrnes, a professor at MIT. Writing in Harvard Business School's *Working Knowledge*, Byrnes asserts that one supply chain is not enough; two, three, or more would be preferable. "One size fits all" supply chains may have been sufficient in the past, he believes, when that was the competitive norm, but advancements in information technology make it possible to have multiple, dynamic supply chains that can accommodate different product and information flows.

Byrnes breaks products into three categories: staples, seasonal products, and fashion products.

- **Staples** (which are much like Fisher's functional products) have steady, year-round demand and low margins. White underwear is an example. Byrnes advises stocking staples only in retail outlets in small quantities and transporting them in truckload quantities. A full truckload is more cost-effective for the shipper than a partially loaded vehicle.
- **Seasonal products** could include outdoor patio furniture, holiday décor, etc., for which the demand is more predictable since it is tied to the holiday or season.
- **Fashion products** are like Fisher's innovative items, with unpredictable demand. Zara, the Spanish clothing brand, has two supply chains, one for staples and the other for fashion clothing. To get the fastest response time, Zara uses European suppliers for the fashion items. But for the more predictable demand items, it uses eastern European suppliers that have poor response time (not a concern) and lower cost.

In addition to varying the supply chain by product type, Fisher recommends several other variables to consider—store type and time in season or product cycle. Demand varies considerably over the life cycle of many products. The same item might have infrequent demand at first, more stable demand in its maturity phase, and falling demand at the end of its life cycle. With more than one supply chain, the nucleus company can move its products from one chain to the other in response to changing variables, such as type of channel or life-cycle stage.

Business plan

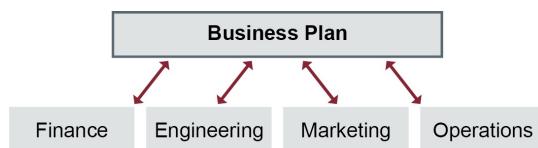
Business and organizational strategies are formalized and clearly specified within an organization's business plan. A business plan is a written document that describes the overall direction of the company and what it wants to become in the future. The *APICS Dictionary*, 16th edition, defines a **business plan** in part as follows:

A statement of long-range strategy and revenue, cost, and profit objectives usually accompanied by

budgets, a projected balance sheet, and a cash flow (source and application of funds) statement. A business plan is usually stated in terms of dollars and grouped by product family. The business plan is then translated into synchronized tactical functional plans through the production planning process (or the sales and operations planning process). Although frequently stated in different terms (dollars versus units), these tactical plans should agree with each other and with the business plan.

The business plan provides general direction regarding how the company plans on achieving its long-term objectives. Key functions such as finance, engineering, marketing, and operations typically have input into the plan. As illustrated in Exhibit 1-12, the overall business plan cascades down to those same functions.

*Exhibit
1-12:
Impact
of the
Business
Plan*



The finance function manages and tracks the sources of funds, amounts available for use, cash flows, budgets, profits, and return on investment. Engineering is responsible for research and development and the design and redesign of products that can be made most economically. Marketing's focus is on analysis of the marketplace and how the company positions itself and its products. You will learn more about the role of marketing in the next section. The goal of the operations function is to meet the demands of the marketplace via the organization's products. Operations also manages the manufacturing facilities, machinery, equipment, labor, and materials as efficiently as possible. These functional roles collectively support the success of the supply chain.

The business plan is based on and aligned with the business strategy and with market requirements. It provides a framework for the organization's performance objectives that are tied to strategic goals. In the ideal world, formation of and changes to the business plan come from top management's modifications to the business strategy and organizational strategy. But in reality that may not always be the case.

Michael Porter, in his influential work on business strategy *Competitive Advantage*, argued that an organization's "fitness" for a given competitive strategy relied on choices related to five fundamental elements of any business. (Note that these are not Porter's famous "five forces" but rather areas that need to be aligned to support a given strategy.)

- **Customer service.** The accuracy, flexibility, and speed of responses and deliveries.
- **Sales channels.** The allowed methods of placing an order for goods or services.
- **Value system.** The value-added activities that the organization—and the supply chain partners—will provide. This requires specifying the core capabilities the organization will pursue and the capabilities that other supply chain partners will pursue to add value.
- **Operating model.** The way plan, make, source, deliver, and return operations are arranged to meet

working capital and cost objectives at the proper level of customer service. Make-to-stock, make-to-order, and engineer-to-order are types of operating models.

- **Asset footprint.** The scope and location of owned and leased property, plant, and equipment; information systems and infrastructure; cost, distribution, and skill levels of human resources; and access to capital.

The idea here is to put the proper emphasis on each element. Rather than isolating the decisions regarding each element, which could lead to suboptimization and conflicting goals, planning for all of these business elements should be integrated to develop a cohesive strategy. The business plan should contain information on these elements in the form of a value proposition, a discussion of core capabilities, a cost structure, and a revenue model. These are discussed next.

Value proposition

The organization's value proposition is the set of activities that the organization will use to actualize strategy and be considered valuable by the organization's customers. The value proposition may also explicitly discuss the value provided by supply chain partners.

The *APICS Dictionary*, 16th edition, defines **value** broadly as "the worth of an item, good, or service." While this merely shifts the discussion from the meaning of value to the meaning of worth, it usefully includes both goods and services. A related concept that is fundamentally important to supply chain management is value added. Adding value to a good or service is the responsibility of each entity and process in the supply chain.

The 16th edition of the *APICS Dictionary* defines **value added** in manufacturing terms as

the actual increase of utility from the viewpoint of the customer as a part is transformed from raw material to finished inventory; the contribution made by an operation or a plant to the final usefulness and value of a product, as seen by the customer. The objective is to eliminate all non-value-added activities in producing and providing a good or service.

The value proposition shows how the organization plans to emphasize each of Porter's five fundamental elements and thus provide the added value as defined by the customer in terms of customer service, quality, increase in utility for the price, and so on. The value proposition is a relative assessment of what is value added. An operation or process adds value if it does so better, faster, and/or more cheaply than the available alternatives. Thus it is benchmarked against competitors and third-party service providers. This analysis results in a set of core capabilities and a set of products or services better rendered by others.

Core capabilities

An organization's core capabilities can be analyzed best by breaking the necessary functions and activities down into categories:

- Decision-making activities
 - Planning
 - Enabling
- Execution activities
 - Sourcing

- Making
- Delivering
- Returning

Organizations may choose to retain the decision-making activities and outsource some or all of the execution activities to organizations that can perform the job with lower-paid workers or other competitive advantages. However, many organizations retain certain portions of execution activities to meet quality objectives. For example, an organization could do its own purchasing and get bulk discounts while controlling quality levels but then outsource the final assembly of the product to a third party who is responsible for final quality and lead time at a lower manufacturing cost.

Core capabilities generally fall within one or more of four areas of competitive advantage:

- Economy of scale advantages allow high use of assets at a low per-unit cost. This can involve bulk purchasing, high capacity production, large quantity shipping, or a large customer base.
- Geographic expertise or capacity advantages take the form of regional networking, business associations, language and culture expertise, or regional economies of scale.
- Technology advantages include proprietary technologies that would be cost-prohibitive to develop or license.
- Resource advantages include currently available expertise or materials or financing that would take time and effort to develop.

Cost structure

Higher levels of customer service, salesperson salaries, website development and maintenance, and in-house versus contracted processes and services will all impose direct costs and overhead on the organization. In addition to this, the final two competitive forces of the operating model and the asset footprint strongly influence the organization's cost structure.

The cost structure of various operating models differs significantly:

- Make-to-stock has low production costs but high inventory carrying costs. This model is best for standardized, high-volume products.
- Assemble-to-order (modules are made to stock but the final customer order is assembled only after being ordered) has moderate production costs and low inventory carrying and planning costs. This model is for moderate- to high-demand items with many options, such as computers.
- Make-to-order has high production costs but low inventory carrying costs and low planning costs. This model is for items that have sporadic demand patterns or that come in a wide variety of configurations or options.
- Configure-to-order (mass-producing items that can be configured after being ordered) is a short lead time extension of make-to-order that has moderate production and inventory carrying costs. It is used when it would take longer to assemble the item than the customer is willing to wait. Delivery times can be reduced and customer experiences tailored.
- Engineer-to-order (e.g., construction of a building) has production and inventory costs that can be

initiated after payment is agreed upon.

The asset footprint is the primary source of an organization's costs. There are three models for how these costs can be configured.

- With the global asset footprint, all production for a good or service takes place at one set of locations for distribution globally. This model increases economies of scale and minimizes unit production costs. It is best for items that require highly specialized expertise and are capital-intensive. There will also be a cost to address business interruption risk.
- With the regional asset footprint, production and sales are localized by region. This cost model is best when transportation costs or time are a significant part of the decision. Products can also be produced to meet regional requirements. Different types of products can be made in different regions for some cross-swapping of products.
- With the country-specific asset footprint, production and sales are localized by country. This model is best when transportation costs or time requirements are prohibitively high relative to the sale price/weight of the good. Avoidance of duties and tariffs or compliance with a country's local sourcing regulations can be other reasons for using this model.

The decisions regarding what to own and what to source through contracts will have a large impact on the organization's cost structure. In addition, some areas have tax incentives to attract business while others have higher taxes. Tax optimization is addressed in more detail in a later section on regulations.

Revenue model

A revenue model is the organization's plan for how it will earn more revenue than its expenses and thus earn a profit. A revenue model considers the sales channels that the organization will employ to sell the good or service. Channels can be direct or indirect, that is, from a dedicated sales force or web page or through intermediaries such as distributors or retailers. Each sales channel will have different profit margins, depending on the cost of setting up and maintaining that channel and the amount of profit that each supply chain partner retains. Customer segmentation and customer profitability are the primary decision points regarding which channels to maintain and promote for which customers. Other decisions related to the revenue model include who gets goods or services when demand outstrips supply and whether to offer channels that directly compete with one another, such as a self-service vending machine or website versus a retail store.

Topic 2: External Inputs

An organization's macro environment includes external influences on strategy that can only be understood, not controlled. (The 16th edition of the *APICS Dictionary* defines **macro environment** as "the environment external to a business including technological, economic, natural, and regulatory forces that marketing efforts cannot control.")

Strategic plans can run right into the brick wall of a harsh economic climate, changing tastes, a competitor with superior offerings at lower prices, or a new government with new priorities or regulations. Therefore, an environmental scan is needed to complete the inputs to supply chain strategy. The idea is to develop a supply chain strategy that is flexible enough to adopt new strategies quickly as demanded by the situation.

An environmental scan can look at the competition, market conditions, and global forces.

Competition

Organizations need to scan the market for what the competition is offering and at what price. They need to know who has what market share in each region in which they would like to compete and whether there are any customer requirements that are going unsatisfied. For example, Haier found that since the power went out frequently in many African countries, there was an unsatisfied demand for a freezer that could stay cold for a long time. They developed a frost-free refrigerator that could keep food frozen for 100 hours without electricity. This helped them keep the majority of the market share in Nigeria.

Getting a foothold in areas where the competition already has established strong market share requires a well-thought-out strategy. When attempting to get a foothold selling mini-fridges in the U.S., Haier started by negotiating contracts with large retailers, including Walmart, Best Buy, and Home Depot. However, a good strategy that is poorly executed can still result in failure.

One way to get an idea of the competition's strategy is to use benchmarking. Benchmarking is discussed in detail in a later section on measuring, analyzing, and improving the supply chain. SWOT (strengths, weaknesses, opportunities, threats) analysis can also be used to get an understanding of the organization's current state of supply chain maturity. This type of strategic analysis is discussed at the end of this section. Other environmental scanning could involve determining how mature competitors' supply chains are relative to one's own supply chain. What your organization believes is a world-class supply chain may in fact be surpassed by other chains. Stages of supply chain evolution are discussed in a later section.

Market conditions

Market conditions include the state of the global, local, and industry economy, the impact of recent events or disasters, and the relative market share that the organization has in a given region at present. Market conditions can be considered challenging when the organization needs to break into a market dominated by other competitors or when the prospective customers are less likely to make a purchase because of the state of the economy. In such situations, the organization's competitive strategy needs to show how the organization's offerings will have a clear competitive advantage.

Information on market conditions can be found from government or third-party reports, surveys, or white

papers on economic conditions. Some of these reports make predictions based on leading market indicators or confirm trends using lagging market indicators. Leading and lagging indicators are discussed in a later section on demand management.

During times of recession or when working to make inroads against an established competitor in a region, an organization can look at these challenging situations as an opportunity to capture significant market share. To do so, it will need to satisfy customer requirements more completely or at less cost than its rivals. Another strategy that often works during recessions is to purchase organizations that are showing signs of weakness at a discount. This can help an organization grow into new global markets.

Global perspectives

The high level of global connectedness is impacting supply chain management and causing it to evolve into a more strategic role. Managers now recognize that the actions taken by one organization in the supply chain can influence the success of the rest of the network. While in the past the strategic focus for many organizations was on improving their internal quality and reducing costs, the new focus is on implementing total supply chain solutions that require collaboration from partner organizations both upstream and downstream.

These new global forces are being met by corresponding technological solutions in supply chains in most nations. Collectively they are revolutionizing supply chain management.

Here are some of the powerful forces that impact virtually every supply chain:

- **Global expansion.** The globalization of sourcing and manufacturing is making supply chains longer and more complex than ever before, thereby requiring more formal coordination and collaboration. Many manufacturers and retail chains have expanded both nationally and globally, creating the need for more formal mechanisms to coordinate supply chain activities. In addition, companies that have created their own e-commerce sites can now have global exposure.
- **Increased project complexity and scope.** Project size and complexity are increasing. Projects involve, in some cases, large teams operating at different remote sites. Moreover, the information involved is more important than ever, in larger amounts than ever, and more difficult than ever to manage manually with the required speed and accuracy.
- **Greater market volatility.** Demand is becoming more volatile and harder to predict due to the increasing power and speed of information available to both consumers and competitors.

A successful global organizational strategy will account for these complexities while developing a deep understanding of local customer requirements. This understanding often requires investing in local managers, experts, and salespersons to develop local sales channels that are attuned to the differences in the given region. Haier has done all of these things in each market it enters, but it keeps track of each region using the standardized measurements of the SCOR® model (a framework for supply chain management), looking at the organization's flexibility, velocity, and predictability, among other things. This way Haier can compare success region to region.

A globalized organization will also need the flexibility to withstand global disruptions. The disruption of just one critical link in a globally interconnected supply chain can impact the whole. When the 8.9 magnitude earthquake and resulting tsunami hit Japan in March 2011, initial concerns and the world's focus were on the people of Japan. As the weeks progressed, it started to become clear in just how many ways we are all connected. Factory operations were affected, raising fears of shortages or price increases for a number of widely used components. Manufacturers were affected by disruptions of the transportation of finished goods to airports or ports as well as the movement of employees and supplies to production plants. Concerns grew that the earthquake and tsunami could lead to a long-term disruption in the world's supply of automobiles, consumer electronics, and machine tools. As millions of people around the globe extended their condolences to the people of Japan for the lives lost and suffering, companies around the globe had to quickly assess whether their business would be impacted by this tragedy thousands of miles away.

Even after this and other major crises and disasters (the economic downturn in Greece, geopolitical conflicts in the Middle East, the World Trade Center attacks of September 11, 2001, in New York, the U.S. recession that was felt worldwide in 2009 to 2010, the volcanic eruption in Iceland in April 2010, when aviation authorities closed the country's airspace due to a cloud of drifting ash), some companies are hesitant to realize that with the global economy, actions in one part of the world, whether planned, unplanned, human-induced, or naturally occurring, seem to affect us. We are all connected.

Our goal is to prepare you to grasp these concepts, be confident in your actions, and eventually thrive in the world of supply chain management. Remember that “the beginning of knowledge is the discovery of something we do not understand” (Frank Herbert, science fiction author and writer, 1920–1986).

Chapter 3: Supply Chain Management Strategy

This chapter is designed to

- Outline the key objectives and elements of supply chain strategy
- Identify specific ways in which supply chain management creates value for all stakeholders.
- Identify factors that can cause an organization to have misalignments or gaps in its strategy
- Discuss how to recognize when misalignments or gaps exist
- Discuss how to resolve misalignments or gaps

Topic 1: Objectives

It's true that companies have always been involved in managing their distinct functions—such as planning, buying, manufacturing, delivering products, and getting paid—but with supply chain management, this has evolved from control of discrete business functions to an emphasis on business process excellence and the management of a network of relationships tied together by complex information flows. Although management of any one activity or link in the chain may be straightforward, achieving the benefits of supply chain management requires strategic planning to master the connected processes.

The objectives of planning and implementing a sound strategy for supply chain management practices, systems, and technologies include

- Improving market knowledge
- Implementing the three Vs—increased velocity, increased visibility, and reduced variability in the flows of goods and services, funds, and information
- Streamlining operations
- Improving management of risk
- Increasing sustainability.

Improving market knowledge

With supply chain management strategies in place, partners in the supply chain begin to share their knowledge about the marketplace and in particular about their customers. It may take some time for the organizations to build trust before they share their account information.

Although market intelligence can be purchased from outside sources, it's most advantageous (and less expensive) to gather it from your partners. There are myriad sources and documents containing valuable customer information that can be shared between supply chain partners, including transaction records, customer survey results, sales and service representative knowledge, and information from distribution points such as retailers, internet sites, or kiosks.

If this kind of market information is not forthcoming from a supply chain partner, another option is to purchase data from survey companies and database marketing companies. Service or finance bureaus can provide broad information about the customer pool. As opposed to the other sources of data listed above, such data do not necessarily paint a picture of a business's own customers. Purchased data may be more useful in acquiring new customers than in managing relationships with existing customers.

Implementing the three Vs

Often called the three Vs of supply chain management, visibility, velocity, and variability are key elements of successful supply chain strategy. No matter what the competitive priority, the goal of supply chain management is to increase visibility and velocity while reducing variability, as seen in Exhibit 1-13. The future of supply chain management lies in continued pursuit of that goal.

*Exhibit
1-13:
The
Three
Vs*



Increased visibility

According to the *APICS Dictionary*, 16th edition, **visibility** is

the ability to view important information throughout a facility or supply chain no matter where in the facility or supply chain the information is located.

Increased visibility along the supply chain is a benefit for supply chain partners and the end customer. With better visibility, a supply chain manager or employee can see the results of activities occurring in the chain and is made aware of minor, incremental changes via technological processes. For example, point-of-sale data may be “visible” to computers in warehouses, the manufacturing plant, and suppliers’ facilities. Data about a sale can instantaneously trigger appropriate actions in all those places automatically. Shipments are scheduled from the warehouse to replenish the retailer’s shelves, manufacturing produces another unit, and suppliers release parts to the manufacturer. With all these actions prompted automatically and instantaneously by technology, the supply chain partners can realize savings in cost and time. Better visibility has resulted in greater velocity.

Increased velocity

The flows of physical materials and services, cash, information, and returns (or the reverse flow) of products for repairs, recycling, or disposal benefit from being increased in speed and efficiency. Supply chain management impacts the velocity of these four flows in a positive manner. According to the *APICS Dictionary*, 16th edition, **velocity** is

a term used to indicate the relative speed of all transactions, collectively, within a supply chain community. A maximum velocity is most desirable because it indicates a higher asset turnover for stockholders and faster order-to-delivery response for customers.

Velocity, like visibility, is enhanced by supply chain management. Methods of increasing the velocity of transactions along the supply chain include

- Relying on more rapid modes of transportation (if there is a net benefit after the increase in

transportation costs)

- Reducing the time in which inventory is not moving (idle, queue, wait time etc.) by using Just-in-Time delivery and lean manufacturing (The less time inventory spends at rest, the less likely it is to suffer damage or spoilage. Increased velocity reduces the expenses involved in warehousing inventory.)
- Eliminating activities that don't add value, thus reducing the time required to accomplish supply chain activities
- Speeding up the flow of demand and cash as well as the velocity of inventory. (The more rapidly payments are received from customers, the sooner the money can be put to work in the business or deposited at interest. Information about demand changes is crucial when the competitive strategy is responsiveness.)

Reduced variability

Variability is the natural tendency of the results of all business activities to fluctuate above and below an average value, such as fluctuations around the average time to completion, the average number of defects, average daily sales, or average production yields.

Supply chain management works to reduce variability in both supply and demand as much as possible. The traditional offset against variability is safety stock. If greater visibility along the chain results in greater velocity, supply chain managers should also be able to reduce the amounts of safety stock required to match supply to spikes in demand. As the "news" about increased purchasing speeds more rapidly up the supply chain, distribution and production can get off to a faster start to meet the demand.

Demand variability has many causes, but a primary cause that can be minimized is the bullwhip effect, which was described earlier. The bullwhip effect is an extreme change in the supply position upstream that is generated by a small change in demand downstream in the supply chain. Inventory can quickly move from being backordered to being in excess due to the serial nature of communicating orders up the supply chain with the inherent transportation delays of moving product down the supply chain.

Supply variability can also be better managed with supply chain management practices. Supply variability typically increases in waves down the chain, starting with small amounts at the resource extraction sites and culminating in the largest amounts at the retail end of the chain. For example, any variability in the supply of a raw material, such as an agricultural product that is dependent upon fluctuating growing conditions, can result in even more widely fluctuating purchase orders for that raw material from buyers down the supply chain. A shortage in supply during one period may result in overpurchasing in the next period, with the excess accumulating in warehouses as safety stock. Buyers depending upon the supply will increase or decrease their purchase orders to reflect the variability of materials, parts, and products available to them, while variability increases at each point in the chain. The accumulating excesses can in turn trigger underpurchasing.

Additional Vs

Supply chain managers should attend to some other Vs, including vocalization, variety, and volume.

Vocalization refers to the need to have good communications between supply chain partners as a vital way to prevent the bullwhip effect rather than just assuming that current orders will form a reliable pattern.

Variety refers to the mix of products and services in a portfolio that must alter to meet changes in customer demand.

Volume is the amount of product being produced in a given time. A supply chain must be flexible enough to expand and contract volume to meet changes in demand for mass-customized products and services.

Streamlining operations

The benefits of supply chain management requires mastery of connected processes. As supply chains evolve, their ability to streamline key operational processes and flows also increases.

With supply chain management, the day-to-day functioning of the organization is smoother, with fewer process-related operational issues, because the organization is adept at

- Identifying each partner and step in the supply chain
- Identifying bottlenecks or problem areas in the supply chain
- Identifying and removing or simplifying unnecessary steps or those that do not add value for customers or partners
- Knowing who is responsible for each substep or task within a larger process and how it impacts the supply chain's performance and output
- Identifying processes that are interdependent and knowing how a change in one will affect another.

The benefits of streamlined operations are felt enterprise-wide and across functions. The resulting increased speed also enhances the flow velocity of cash, information, and physical materials and services in the supply chain.

Improving management of risk

All investments involve risk, including those made in any supply chain. Risk is generally defined as a hazard, a source of danger, or a possibility of incurring loss, misfortune, or injury. With supply chain management, the organization develops a risk management strategy and plan in advance that describe how it will address vulnerabilities by avoiding, accepting, transferring, or mitigating risk. Managing risk proactively gives an organization an edge over its competition.

Proactive risk planning benefits the organization in a number of ways:

- It helps keep the supply chain flexible so that it can continue functioning despite disruptive events, which in turn helps balance the costs of contingency planning against the potential economic, facility, resources, and inventory losses.
- Risks are shared among supply chain partners who will be prepared to work in concert and play their parts responsibly. For instance, before Hurricane Katrina deluged New Orleans and other locations along the U.S. Gulf Coast, Walmart had a fleet of trucks in place and was ready to roll into stricken areas with supplies. A strong supply chain is more than good business; it yields another advantage: good citizenship.
- Risk planning prepares the employee workforce and supply chain partners with valuable, actionable information and confidence to handle nearly any situation with a well-thought-out strategy based on substantiated risk data.

With a risk strategy and plan in place, supply chains typically improve their chance of keeping material,

information, and payments flowing through the network and arriving everywhere in the right numbers at the right time and in good shape even if a risk event occurs.

Supply chain risk management is covered in detail in a later section on managing risk in the supply chain.

Increasing sustainability

“Sustainability” and “green” are often used as synonyms in discussions of corporate obligations that go beyond the traditional emphasis on bottom-line profits. Both terms refer to the need for economic activity to operate within limits imposed by natural resources.

Business (and consumer) practices that rely upon energy derived from fossil fuels, for a much-discussed example, cannot be sustained beyond the availability of such energy resources. Supply chain management incorporates sustainability efforts such as the replacement of resources as they are used (as in the planting of seedlings as part of forest management) and increased usage and reliance on wind and solar energy to power manufacturing processes.

Sustainable supply chain management is covered in greater detail in a later section.

Topic 2: Value

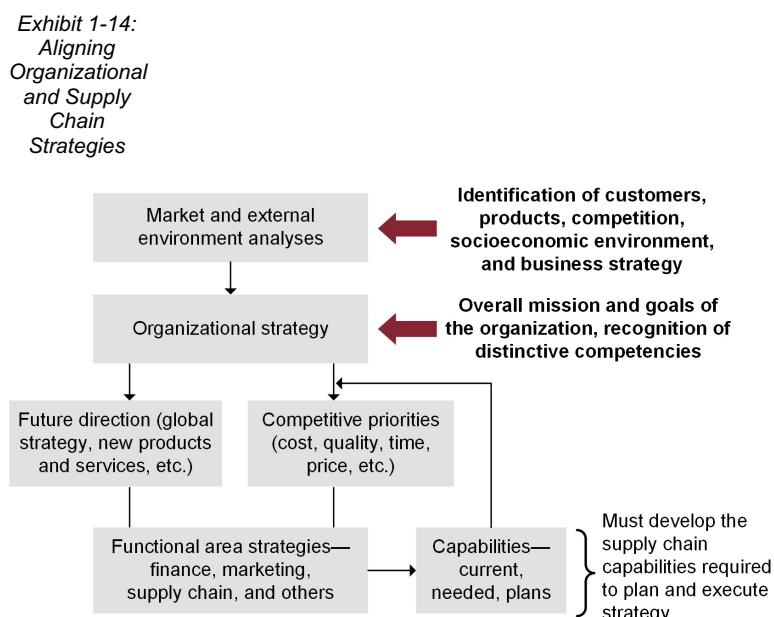
The supply chain has the overarching goal of providing customers with goods and services when and where they want them, at a competitive price, while being consistent with the strategies of the organization and the extended supply chain. If the supply chain cannot successfully execute this strategy, the business, or product line, may cease to exist.

When you think about the role the supply chain plays in the bigger context of an organization, remember that the functional strategies underlying supply chain management must articulate with the business plan, and remember also that the purpose of supply chains is to be globally competitive. Time, distance, and collaboration are basic elements in modern supply chains that impact the chain's ability to respond to competitive changes in the global marketplace. The relationships of time, distance, and collaboration weave like three bright threads through the fabric of any supply chain on the globe.

Alignment of organization and supply chain strategies

Whatever type of supply chain a company establishes internally across functions and externally with trading partners, success depends first upon alignment of supply chain strategy and organizational strategy (or organizational strategies, in the case of horizontal supply chains).

When it comes to aligning organizational and supply chain strategies, it's useful to think about the process in terms of a flowchart. Exhibit 1-14 provides a graphic representation of the strategic decision-making process that goes into aligning organizational and supply chain strategies.



This flowchart shows that

- The management of the organization must first identify its customers, products, competition, and socioeconomic environment and then determine the mission and overall goals that support those factors. The organization needs to be able to identify and leverage its distinctive competencies and note the areas where it lacks expertise, since those capabilities can later be outsourced if deemed appropriate.
- These decisions feed into the organization's market and external environment analysis as well as its organizational strategy.

- They in turn drive the future direction and competitive priorities, which then help determine the appropriate strategies of the various functional areas like finance, marketing, and the supply chain.
- Those strategies drive the supply chain capabilities of the present, the immediate future, and the long term.
- These supply chain capabilities feed into a continuous loop and help the organization determine how to continuously adjust its competitive priorities of cost, quality, time, and price to support its dynamic organizational strategy.

Once the supply chain strategy is in place and there is confirmation that it is properly aligned with organizational strategy, the organization will likely need to be flexible and change the supply chain strategy when circumstances warrant taking a new direction.

Supply chain strategies need some of those same elements as an organization's business model:

- Value proposition
- Core capabilities
- Cost structure
- Revenue model

Value proposition

Like the organization's overall value proposition, a supply chain strategy needs to show how it will create value for the organization. Supply chain management, like any other type of business management, aims to create value through financial benefits and to provide value to customers and other stakeholders by upholding the ethics of customers, stakeholders, and community.

The goal is to add value at each step in a service-oriented value chain as well as in a manufacturing-oriented supply chain. Note that utility may not be the only value, or worth, of a good or service from a customer's point of view. Price, availability, and attractiveness are also values to consider.

Value chain and mapping

Although many would assume that a supply chain is, in fact, a value chain—at least it is if well managed—others may draw a distinction between the two. A value chain is a string of collaborating players who work together to satisfy market demands for specific products or services. According to the *APICS Dictionary*, 16th edition, the **value chain** is made up of “the functions within a company that add value to the goods or services that the organization sells to customers and for which it receives payment.”

Value chains integrate a variety of supply chain activities throughout the product/service life cycle, from determination of customer needs through product/service development, production/operations, and distribution. The intent of a value chain is to increase the value of a product or service as it passes through stages of development and distribution before reaching the end user.

Not all value chain activities are technically part of the supply chain, and those engaged in them may not understand their role in supporting the supply chain. Those activities might include engineering, marketing, finance, accounting, information technology, human resources, and legal. Managers from outside the supply chain often don't understand the requirements of supply chain management, can't distinguish a value chain from a supply chain, and consequently don't provide the supply chain management support required from their areas.

Two closely related terms are value stream and value stream mapping.

As defined in the *APICS Dictionary*, 16th edition, a **value stream** is

the processes of creating, producing, and delivering a good or service to the market. For a good, the value stream encompasses the raw material supplier, the manufacture and assembly of the good, and the distribution network. For a service, the value stream consists of suppliers, support personnel and technology, the service "producer," and the distribution channel. The value stream may be controlled by a single business or a network of several businesses.

A value stream encompasses all the primary actions required to bring a product or service from concept to placing it in the hands of the end user. It also includes timing. Mapping the stream aids in process improvement, which will be discussed in depth in a later section.

Value stream mapping is defined in the *APICS Dictionary*, 16th edition, as

a lean production tool to visually understand the flow of materials from supplier to customer that includes the current process and flow as well as the value-added and non-value-added time of all the process steps. [It is] used to lead to reduction of waste, decrease flow time, and make the process flow more efficient and effective.

On the following pages, Exhibit 1-15 shows a basic process flowchart for a supply chain, and Exhibit 1-16 shows how an organization can apply value stream mapping to find the most effective production flow for that supply chain process.

**Exhibit 1-
15:
Process
Flowchart
Example**

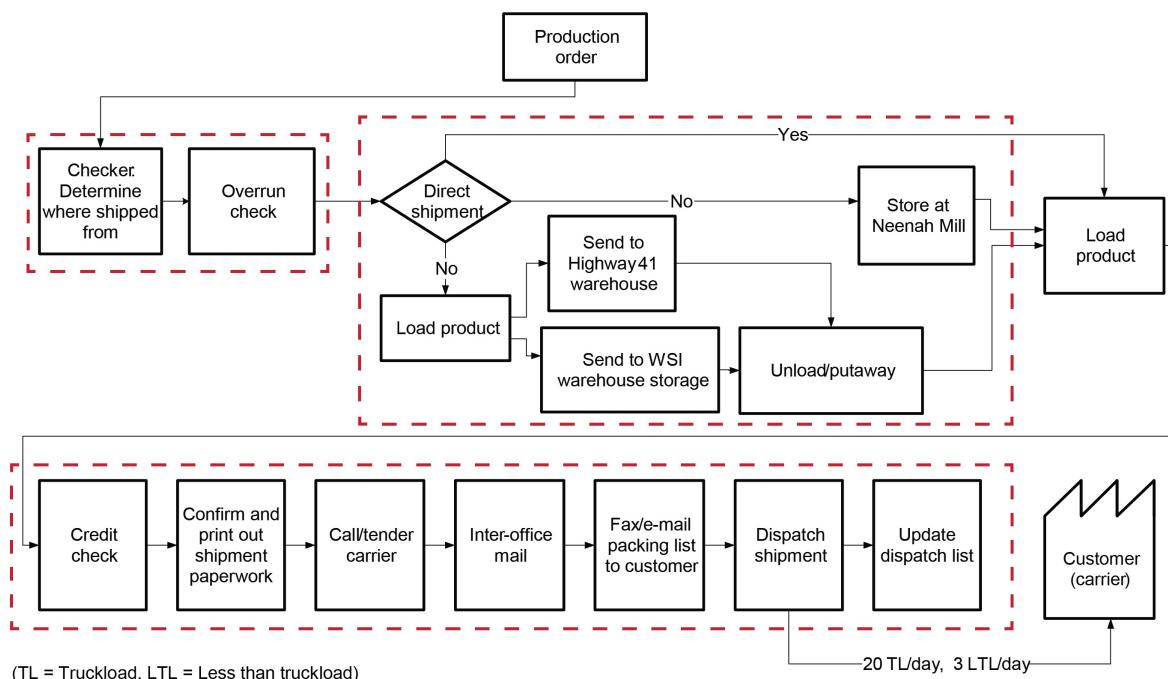
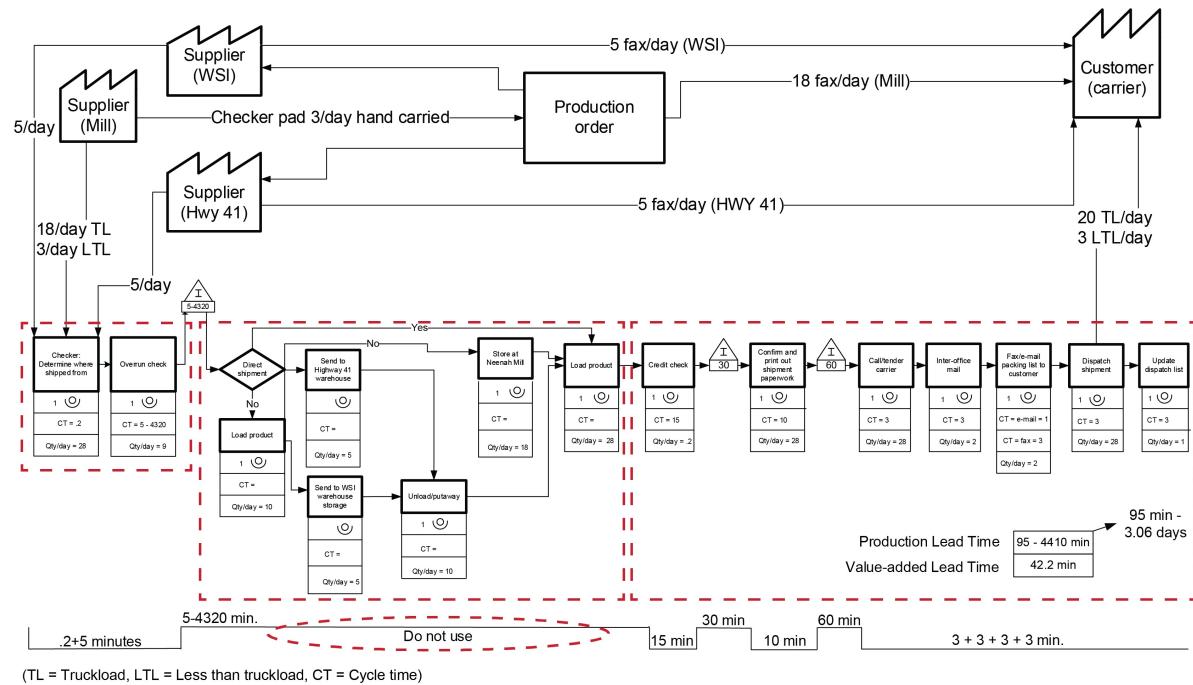


Exhibit
1-16:
Value
Stream
Mapping
Example



Financial benefits

Adding value that customers desire promotes increased sales, which can lead to an improved bottom line. In order to be successful and have longevity, organizations need to have positive cash flow. Profit is cash remaining from revenues after deduction of certain expenses.

Another related term, triple bottom line (TBL), coined by author and sustainability advocate John Elkington in 1994, refers to the concept that corporate success should be measured in three dimensions—economic, social, and environmental—and not only by the traditional bottom line of relative profitability. The TBL is covered in a later section.

Stakeholders and value

When planning any new supply chain activity or monitoring continuing practices, it is important to identify all the stakeholder groups and determine the impact the activity will have on each one.

The primary stakeholder in any business activity is the **business** itself. A business must be profitable to survive and create value for any other stakeholder group. A supply chain, however, may touch many businesses, not just one. And each business will have its own view of the potential value of any particular activity. As a simple example, a supplier may decide to increase profits by raising the price of goods purchased by its downstream supply chain partners. But the resulting negative impact on those partners and on the end customer may make a price increase unwise.

Customers are also significant stakeholders in supply chains. And there are many customers in a supply chain, not only the consumer of the ultimate good or service delivered through the supply chain. Each business must create value for its customers as well as profits for itself. Moreover, the end result of each partner's activities must optimize value for the supply chain as a whole.

There are also stakeholders that are external to the supply chain's business partners and end customers. These include investors, lenders, communities, and governments.

To **investors and lenders**, supply chain value may be defined as capital growth, dividend income, or interest payments and eventual return of invested capital. Investors expect returns to be greater than those that could be earned from a market investment of similar risk. Value as defined by these external partners must be considered when making business decisions.

Communities and local governments may also feel the impact of supply chain operations because they affect community members and their environment. The location of a retail outlet, warehouse, or other supply chain facility will have an impact on the community where it is built and maintained. The community, and its political leadership, may judge this impact to be a positive value (e.g., jobs) or a detriment (e.g., pollution or noise). These reactions, as well as the overall impact on supply chain profitability, must be taken into account.

Stakeholders usually have different views of what value a supply chain should create, and supply chain activities that are beneficial to one stakeholder group can be harmful to another. So managing a supply chain successfully sometimes requires balancing increases in value for one stakeholder with decreases for another. Everyone must be satisfied enough to continue participating. Customers have to keep buying, investors have to keep investing, workers have to keep showing up and giving their best, communities must be satisfied with each supply chain partner's impact on social and environmental values, and so on.

Exhibit 1-17 lists some typical supply chain stakeholders and various values they may realize from supply chain management.

Exhibit 1-17: Supply Chain Stakeholder Values

Supply Chain Stakeholders	Stakeholder Values
Companies in the supply chain	Profit margin, market share, revenues, expenses, image and reputation
End customers	Affordable, safe, attractive, useful products; affordable, timely, secure, easy, pleasant services; sustainable manufacturing practices
Investors	Return on investment (capital growth, dividend income), comprehensive and comprehensible communications
Lenders	Interest rate, long-term stability, return of principal
Communities/environment	Tax base enhancement, sustainable manufacturing practices, environmental impact (safety, esthetics, convenience, natural resources), growth of attractive jobs
Governments	Legality, regulation, overall impact on community members and environment
Employees	Job security, wages and benefits, opportunity, good working conditions, sustainable and safe manufacturing processes

Types of value

Supply chains should create three types of value—financial, customer, and social—regardless of whether they are functioning within for-profit companies; nonprofit, charitable, or governmental organizations; or branches of the military.

Financial value

One method of increasing financial value is to reduce costs. Take these considerations into account when looking for

opportunities to lessen expenses within a supply chain:

- **Cut costs to yield net gains at the bottom line.** One danger in pursuing cost reductions is the possibility that spending less in one area of the business will simply mean spending more elsewhere or even possibly creating a net loss. In the early stages of supply chain evolution, this sort of self-defeating tradeoff happens all too often. The warehouse manager might, for example, eliminate one or more storage facilities to save warehousing costs without consulting the traffic manager about the need for compensating changes in transportation.

A more evolved supply chain management function analyzes relevant data, including data on demand and transportation cost, to derive the appropriate size, location, and number of warehouses using sophisticated inventory optimization software—and perhaps putting the entire process under third-party management. The same consideration holds throughout the supply chain. (The *APICS Dictionary*, 16th edition, defines **inventory optimization software** as “a computer application having the capability of finding optimal inventory strategies and policies related to customer service and return on investment over several echelons of a supply chain.”)

Changes at any one point in the system will create changes elsewhere; therefore, change has to be viewed holistically. Supply chain management necessitates cross-functional teamwork for the internal change and cross-entity teamwork for the lateral chain. The guiding principle always has to be creation of value at the customer's end of the chain. If a leaner supply chain can deliver the same customer satisfaction with a greater profit, then cost cutting is justified.

- **It takes money to make money.** Many of the improvements in supply chain performance require investments of money up front to realize greater revenues, profits, or both down the line—or simply to remain competitive on a global playing field. As always, the end result has to be a net gain. If an improvement in the supply chain brings in more revenue than the cost of the investment, then it's justified. Purchasing automated machinery to improve warehousing, upgrading hardware and software, training managers in team building, and other investments may be necessary to build and maintain a competitive supply chain. Again, the ultimate aim must always be creation of value at the customer's end of the chain—with sufficient profits to satisfy the needs of other stakeholders.

Typical measures of success in the use of invested money and assets more generally are **return on investment (ROI)** and **return on assets (ROA)**. ROI is defined in the *APICS Dictionary*, 16th edition, as “a relative measure of financial performance that provides a means for comparing various investments by calculating the profits returned during a specified time period.” ROA is defined as “net income for the previous 12 months divided by total assets.”

- **Gains should be equitably distributed.** Be careful when pursuing increases in supply chain efficiency or effectiveness that might result in a financial gain that is not distributed with the needs of all stakeholders in mind. Possibly the most common mistake in this regard is to send all cost savings all the way to the consumers' end of the supply chain. If all efficiencies are plowed into retail price reductions, the supply chain itself will suffer from lack of financial sustenance.

While customer discounts bring immediate gains in volume and market share, other stakeholders also have to be rewarded. Investors require a competitive return on loans and equity. Maintenance and upgrades to the supply chain's infrastructure often require continuous reinvestment. Employees have to be compensated at a competitive rate, trained in new processes and products, and, more fundamentally, recognized for their contributions. Research and development need support in locating market needs and creating products and services to satisfy them.

And perhaps most challenging of all in a lateral supply chain is the need for productive sharing of any financial gains. For instance, a powerful nucleus firm can rake in the benefits of an alteration in the placement of inventory (or any other process change) at the expense of its suppliers. This has the potential to be self-defeating if it drives away quality suppliers. Teamwork among supply chain entities can create improved value for customers for a net financial gain that is equitably shared by all stakeholders.

Customer value

In a competitive economy, making money depends upon responding to customers' needs. The ultimate goal of market-driven supply chain management, therefore, must always be to deliver products and services that the customer values—and, of course, will pay for.

Depending upon the market being served, a supply chain may be managed so that it delivers one or more of these values to its end customers:

- **Quality of product or service.** Quality applies to all products and services, from the production of a basic commodity like a bed mattress to the reliability of 4G network services for smartphone performance. Decisions all along the supply chain have to be coordinated to achieve the appropriate level of quality through the right design, the right production, and the right materials.
- **Affordability.** Almost all products and services have an appropriate price level, one to which the market will react favorably. The supply chain has to invest in the processes, people, and technology conducive to creating a product at the right price. If a company's marketing strategy is to provide the best everyday low price, the affordability demands complete efficiency in the supply chain. Supply chain managers who are operating with those types of goals must develop collaborative design processes that result in specifications for products of good quality that can be efficiently manufactured from readily available materials by well-trained workers who function efficiently and effectively within a well-defined supply chain process.
- **Availability.** For some products or customers, availability is of paramount value and the supply chain has to be designed to deliver products and services right on time. This may affect not only the placement of inventories but also the selection of transportation modes (overnight delivery, refrigerated containers, etc.).
- **Service.** There is an indistinct line that separates product and service. For example, the process of delivering a vehicle to a customer is intertwined with related services—financing, dealer preparation, sales, warranty agreements, and repair and replacement services at the dealership. An effective supply chain management process will ensure that service issues are incorporated in the product design stage. Collaborative design will include input from marketing, manufacturing, and supply to create a product that is easy to repair. At the same time the team will implement an efficient reverse chain that takes a vehicle or its parts back for repair, replacement, or recycling.
- **Sustainability.** Consumers and customers are a driving force behind environmental and social supply chain innovation. For individual consumers and advocacy groups, sustainability is typically a matter of what is important to them and what they are willing to pay. Consumer opinion for or against a company's environmental practices may be shaped by the media, community groups, environmental organizations, lobbyists, and others who exert social pressures. It is difficult to forecast exactly how much of a premium consumers will pay, for example, for ethically sourced products or items manufactured under high environmental and socially acceptable standards. Consumers may also call attention in various ways (boycotts and letter-writing campaigns, for example) to violations of regulations bearing upon sustainability.

If, for example, availability is a key value to customers, emphasis in the planning stage might be placed upon

outsourcing to air express delivery companies with overnight delivery capability, even if that requires putting extra resources into logistics and cutting back elsewhere to stay within budget. Similarly, perishable quantities—which tend to be of high value—require special handling by high-end carriers. On the other hand, if the customer doesn't value immediate availability (and the product doesn't require it), then putting money into rapid delivery is not a rational supply chain decision. There is no logic in making customers pay for quality or service they don't value.

An international fashion clothing brand such as Zara, which is now in 88 countries, succeeds by focusing its attention on its customers' values—creativity, quality design, and rapid turnaround—to capture and quickly deliver the latest trends in taste for each new season. All their decisions about suppliers and distribution must serve those goals.

Social value

Supply chains are also judged on their contribution to society. Generally speaking, these contributions come from three factors.

- **Delivering socially desirable and useful products or services.** Supply chains deliver products and services that are embedded in a social and cultural environment. Businesses produce what society demands. Sometimes the connection between private business and public need is direct. For example, heavy manufacturers serve governments directly when they produce motor vehicles and aircraft for the military. Those vehicles not sold to governments serve social purposes by providing transportation for vehicle owners and passengers. Bullet trains in Asia and Europe exist because those societies value speedy public transportation. Beyond the production of goods and services, supply chains also affect society by the number and types of jobs they create and in the generation of tax money to support social purposes.
- **Avoiding or reducing negative environmental side effects from extraction, processing, and construction.** In the past several decades there has been growing attention to the impact of business on the natural environment. This applies to supply chain activities all the way from extraction of raw materials through manufacturing processes, logistics, and distribution. Through laws and regulatory agencies, society requires businesses to contribute, through sustainable practices, to a healthy environment. Conforming to these regulations has become an increasingly significant part of supply chain management. This has also resulted in the identification of the reverse supply chain, which handles products being returned by customers and those that have reached the end of their life cycle. Reverse logistics and the reverse supply chain are covered in a later section.
- **Integrating sustainability into the supply chain.** Much of this progress in reducing negative impact on the environment is tied to sustainable supply chain management. Without forward-looking environmental and social policies and supply chain practices, an organization's reputation may suffer among investment analysts. Sustainable supply chain management adds important stakeholder value. You will learn more about sustainability and supply chains in a later section.

Supply chain capabilities

As with the value proposition, both supply chain strategies and business models need to consider an organization's core capabilities. First, though, we'll look at the general capabilities needed in a supply chain.

General capabilities

A supply chain strategy needs to specify how it will arrange and prioritize its various capabilities. Every supply chain is made up of organizations, people, processes, and information. Each supply chain's capabilities are based on its

- Organizational design
- Processes

- Systems and technology
- Human resources
- Metrics (measurement techniques).

The success of any supply chain in achieving its goals of creating value for customers as well as financial value requires thoughtful, strategic planning regarding these capabilities.

Organizational design

According to the *APICS Dictionary*, 16th edition, **organizational design** refers to

the creation of an organizational structure to support the strategic business plans and goals of an enterprise (e.g., for-profit and not-for-profit companies). Given the mission and business strategy, the organizational structure design provides the framework within which the business operational and management activities will be performed.

Organizational design also encompasses how the organization communicates internally and externally, the chains of authority and responsibility, financial management, and job hierarchy and descriptions.

Supply chain processes

Supply chain management covers a series of linked processes. Although management of any one activity or link in the chain may be straightforward, effective supply chain management requires mastery of these connected processes.

Systems and technology

Being able to implement and manage sophisticated software that can automate various supply chain activities is a critical capability. Organizations that have developed integrated networks, like intranets, extranets, and mobile-ready internet, will be prepared to handle the complex and numerous transactions involved in supply chain management. Some organizations may use computer networks to tie together the various software applications supporting specific activities within supply chain processes. They may use packages that enable them to manage operations at various levels: from one plant, to enterprisewide integration, and on to cross-company functionality.

Many organizations use an enterprise resources planning (ERP) system to provide transactional support for multiple business processes. ERP is a framework for organizing, defining, and standardizing the business processes used to plan and control an organization's internal knowledge to gain external advantage. ERP systems enable critical links between strategy and operations. They can be designed to support the specific capabilities that a company desires. At its core, however, ERP is an accounting-oriented database system that can coordinate information flow between various parts of the organization and the extended enterprise. There is more information on ERP and other technologies mentioned here in a later section on technology design.

If an organization decides it needs the capability to pick up sales data and send it instantaneously throughout a network for use in revising forecasts and triggering operations along the supply chain, then it may purchase the technology to use bar codes on products and radio frequency devices. The companies might then feed these data into databases for marketing analysis to gain insight into customer behavior.

This plethora of technological advances does not come without its challenges, however—for any organization. There have been, and still are, technological hurdles to surmount in this evolution, such as the incompatibility of programming languages and different software applications and network protocols. There are also human and organizational barriers that can prevent taking full advantage of available technology. Despite the steady moderation of price and user-friendly electronic linkages, some departments or users may question the usefulness and related

costs of technology. New users of this technology have to be trained, and, in some cases, they also have to be converted from a skeptical to an accepting attitude toward new technologies.

The most significant challenge might be a lack of trust among companies along the supply chain and even across functional areas or teams within organizations. Integrating supply chain processes means sharing data, and that is generally seen as a risk. But there's little point in network connectivity if supply chain partners can't use those connections to process shared information. Change management is therefore critical in implementing technology design. Change management is discussed in a later section.

Human resources

An organization is significantly impacted by the manner in which it creates and organizes its functions and how the people within the departments manage the business operations and key processes. Admittedly, very few organizations have a department called "supply chain management." Horizontally organized supply chains typically have no unified ownership or management structures (unlike vertically integrated supply chains). Yet the development of supply chain strategy and the control of supply chain processes depend entirely on having the right people in place—people educated in supply chain thinking rather than functional thinking.

Supply chain partner organizations need to have the capability to develop expertise in hiring and training and to properly deploy highly skilled, process-oriented, and knowledgeable supply chain specialists to design and monitor supply chain processes. Of necessity, supply chain management sometimes draws upon personnel attached to multiple functions, yet they may be available only part-time to the supply chain team.

Unlike specialists in traditional functions—production, logistics, procurement, etc.—an organization needs supply chain personnel with expertise that extends beyond deep knowledge of one area or functional discipline. These personnel need to be broadly knowledgeable about the enterprise as a whole and trained in the art of inspiring people who have different skills and attitudes to work harmoniously in pursuit of a common goal. People on supply chain teams may represent every function, from procurement to marketing. On occasion, the supply chain manager may need to work as a diplomatic go-between when mistrust and misunderstanding prevent team members from cooperating with one another.

In addition to the multidisciplinary, communication-savvy, holistically oriented supply chain manager, the company needs people with other special skills that will contribute to the success of supply chain initiatives. For instance, a team member with cost-management skills comes in handy when planning an initiative. With so much pressure to keep costs low, an initiative to upgrade supply chain technology or optimize the logistics network must be skillfully managed to keep costs in line and avoid driving up product prices. Modeling the process in advance with data from supply chain partners can help increase efficiency when the real work begins. In addition, supply chain management initiatives need the help of technology specialists with skill in business software, web development, and electronic networks.

Finding and developing the level of talent required to manage supply chains implies skilled and knowledgeable human resources management and skilled staff. Especially in large organizations with complex bureaucratic structures, human resources policies may work against, rather than in conjunction with, the supply chain strategy. This underscores the rationale of the supply chain being the responsibility of an executive-level champion.

In sum, an organization needs to be staffed with supply chain professionals, full- or part-time, who can do the following:

- See the supply chain as one continuous entity made up of linked processes.
- Manage relationships among team members and between teams to coordinate different temperaments and

visions.

- Understand the corporate business model and its alignment with the supply chain.
- Manage costs skillfully for the chain as a whole (understand net value).
- Identify and buy or develop technology to provide the entire supply chain with access to data and the ability to transform the data into information for use in real-time management of supply chain process flows (visibility and velocity).

Supply chain metrics

Finally, an organization must be capable of measuring key supply chain indicators and must have its metrics in place. Metrics, also known as performance measurement systems, are systems for collecting, measuring, and comparing a measure to a standard for a specific criterion for an operation, item, good, service, business, etc.

If asked questions such as "How well is the supply chain performing?" or "Is our supply chain helping or hurting corporate objectives?" the answer should include a meaningful measurement. There are a number of obvious measures for assessing an organization's current performance:

- Past performance (to show how much it has improved)
- Future desired performance (to show how close or distant from goals)
- A competitor's performance
- Industry average performance ("We're better than average!")
- World-class, or best-in-class, performance from any industry for the same activity or process you're assessing

Numbers generally provide the most convincing supporting evidence in the boardroom and the investment analyst's office. When discussing your cash-to-cash cycle, for instance, you might say "We've got it down from 50 days to 20, and that's better than the industry average."

Organizations can also use a checklist to measure performance. This could include certain activities, types of equipment, technologies, etc. One example is the Oliver Wight supply chain excellence checklist. (Refer to the Resource Center for more information.)

Summing up

Taken together, the five elements just discussed determine the capabilities of organizations within a supply chain. In the ideal world, each organization in the supply chain would have the following:

- Integrated organizational design with a process orientation
- Key supply chain processes already in place and functioning at competitive velocity
- Systems and technology sufficiently advanced to tie all processes together and allow the supply network to operate from the same, simultaneously available data
- Educated and skilled employees who have a process focus, can see the end-to-end supply chain as a single entity, and manage accordingly
- Metrics that are in place to assess performance against a relevant standard and identify strengths to encourage and weaknesses to amend

Let's look at an example of when this alignment is in place and working well. One major international petroleum company, for example, instituted advanced information technology to convert from a forecast-driven to a demand-driven enterprise. Demand data from filling stations and large industrial customers became available throughout the supply and distribution networks for use in marketing, logistics, planning, and refining. These shared demand data fed into virtually every decision made along the supply chain, from spot-market purchases to scheduling of refill runs. When all supply chain processes operated from the same base of data, the partners functioned as seamlessly as if they were one company. That's what's meant by a "virtual network," but in fact the network is very real. It's the

company that is virtual (i.e., not really a company but a set of cooperating entities).

All of these supply chain capabilities should be aligned with one another and with the supply chain strategy.

Core capabilities

An organization's supply chain management function will excel in certain areas. Core capabilities may be intangible items such as excellent management skills or a polished brand image. Determining core capabilities involves considering how an organization's internal capabilities differentiate it from its competition in each of the following key items:

- Adding value to products, such as shorter time to market
- Improving market access, such as providing new market channels
- Building financial strength through increased income and shared costs
- Adding technological strength if there is internal expertise in the use of more advanced software and systems
- Strengthening operations by lowering system costs and cycle times
- Enhancing strategic growth to break through barriers to new industries and opportunities
- Improving organizational skills that facilitate shared learning and insights among management and employees (internally and/or among other partners)

While there may be gaps in core capabilities that can be the focus of change initiatives, the idea is that the organization will continue to invest time, energy, and money in maintaining and improving things it does better than anyone else (or wants to do better than anyone else) and it will retain these functions in house. By contrast, things that are not core capabilities are things that others can do better, faster, or more efficiently. Usually this means it is more cost-effective to leverage third-party strengths for these capabilities than for the organization to continue to do them.

Organizations leverage their core competencies in order to achieve defined goals and objectives. The following supply chain management objectives are key areas to consider when implementing a business strategy and determining where to invest:

- Excellence in customer service
- Effective and efficient use of systemwide resources

Since non-core capabilities are usually contracted out to organizations who excel in meeting these objectives with their own core capabilities, after discussing the objectives above, we will discuss efficiently and effectively leveraging partner strengths.

Excellence in customer service

In terms of supply chains, **customer service**, according to the *APICS Dictionary*, 16th edition, is “the ability of a company to address the needs, inquiries, and requests from customers.” It can also be explained as a “measure of the delivery of a product to the customer at the time the customer specified.”

As part of supply chain management, a company will develop and use its customer service strategy to identify and prioritize all activities required to fulfill customers' logistical requirements at least as well, or better, than the competition does. The strategy will include the fundamental attributes of basic customer service: availability, operational performance, and customer satisfaction. By implementing a strategy that takes these factors into account, a company can target the measures that are weak and improve its customer service. Let's take a closer look at each of these attributes.

- **Availability** is having the product where and when it is wanted by a customer. Traditionally, many

organizations have stocked product in anticipation of customer orders and based on demand forecasts. But by using supply chain management, a company can achieve high levels of availability while keeping its investment in inventory and facilities to a minimum. It is less likely to have products out of stock over time and is more able to ship complete orders. (If a customer order is missing only one item out of several, the order is considered incomplete.) In a later section you will learn more details about three performance measures tied to availability: stockout frequency, fill rate, and orders shipped complete.

- **Operational performance** deals with the time needed to deliver a customer order. When supply chain management is in place, the elapsed time from when the customer places an order until the product is delivered and ready for use is reduced. Well-designed logistical systems facilitate a speedy delivery but may also result in higher costs. Ideally, operational performance also means that the supply chain is flexible in that it can accommodate unexpected or unusual customer requests and that there are contingency plans in place if there is a service breakdown or a malfunction occurs.
- **Customer satisfaction** takes into account customer perceptions, expectations, and opinions based on the customer's experience and knowledge. With supply chain management in action, customer expectations are discussed and clarified based on real supply chain data. So once the completed products and orders reach the customer, they will meet customer expectations in terms of quality, price, and delivery. Increases in customer satisfaction are the goal, as supply chain management strives to continuously improve with time and build successful long-term relationships.

Effective and efficient use of systemwide resources

For a supply chain to be effective in its use of resources, it must use them in a manner that helps the organization achieve its business objectives. Resources can be in the form of employees, raw materials, equipment, etc. Being effective means that the supply chain gets the right product and the right amount to the right customer at the right time. Effectiveness is being outward-focused—on the customer's needs and wants—while still meeting cost objectives. For instance, if a supplier encounters a glitch in its normal mode of over-the-road transport of car headlights that it makes for an auto manufacturer, it could still get the order to the customer on time if it sends the headlights via air. Air is more costly, but it does contribute to the company's effectiveness in meeting its customer needs.

Companies use a variety of tools and metrics to measure effectiveness, such as benchmarking and comparing the company's actual performance against its organizational strategies for growth, increased sales, increased customer satisfaction ratings, or improvements in the metrics of the SCOR framework. Supply chain management enables an organization to be more effective in reaching these types of strategic goals.

Efficiency is defined, according to the *APICS Dictionary*, 16th edition, as

a measurement (usually expressed as a percentage) of the actual output to the standard output expected. [It] measures how well something is performing relative to existing standards.

Efficiency is inward-focused, in that a company looks internally to determine how a supply chain process can be done less expensively, in less time, and with fewer resources.

Efficiency is one of the measures of capacity in a supply chain environment. Capacity is all about what can be accomplished by employing all the resources in the supply chain network. That includes work centers, storage sites, people, and equipment. According to the *APICS Dictionary*, 16th edition, **capacity** has two meanings:

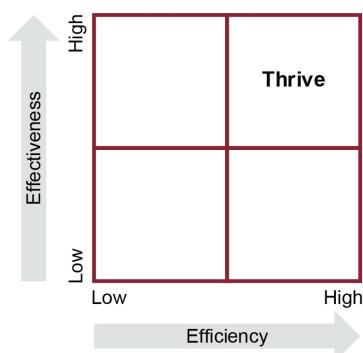
- 1) The capability of a system to perform its expected function.

2) The capability of a worker, machine, work center, plant, or organization to produce output per time period.

Supply chain management can increase the efficiency of any mix of manufacturers (or service providers), suppliers, and customers in a supply chain. When a supply chain is operating at high efficiency, it means that it's utilizing its resources well to produce the level of output in a production plan within the time allowed.

There are often tradeoffs between effectiveness and efficiency, as illustrated in Exhibit 1-18.

*Exhibit 1-18:
Balancing
Effectiveness
with
Efficiency*



Efficiently and effectively leveraging partner strengths

Supply chain management enables an organization to leverage the strengths of its partners. If the organization is able to recognize when another organization is stronger in certain core capabilities, at least in certain specialized areas or regions of the world, then it will be in a position to leverage these competitive advantages.

According to the APICS Dictionary, 16th edition, a **partnership** can be one of two things:

- 1) A form of business ownership that is not organized as a separate legal entity (i.e., unincorporated business), but entailing ownership by two or more persons.
- 2) A relationship based on trust, shared risk, and rewards aimed toward achieving a competitive advantage.

The latter definition refers to a partnership in a supply chain. Unless otherwise noted, in this learning system, the terms "partner" and "partnership" are used to describe a collaborative ongoing organizational relationship aimed at achieving a competitive advantage rather than a formal business combination.

If the organization and its partners can achieve more together than they could have individually, then mutual strengths are being effectively leveraged. The selection of the "right" partners means that their corporate culture, operating styles, and business practices are similar enough for the benefits of an alliance to outweigh the negatives. Well-chosen partners will benefit from a high level of mutual trust, respect of each other's expertise and contributions, and a shared common vision.

In order to leverage a partner's strengths, the organization must identify the partner's core strengths or competencies. With a strong partner, both members in the relationship can pool their resources and work together to continually search for ways to improve sales, productivity, and competitiveness.

Supply chain management technologies and practices can help a company select the appropriate partners and support them by

- Providing timely and accurate information
- Helping them deal successfully with channel customers
- Aiding them in leveraging their strengths, such as innovation, speed, high quality, low cost, etc.

You will learn more about collaborative partnerships and their advantages in a later section.

Cost structure

We've seen how the supply chain's value proposition and core capabilities must reflect those of the larger organization. A supply chain's cost structure also needs to support the organization's cost structure. The same balance of spending on customer service, sales channels, value system, operating model, and asset footprint will form the cost structure. In other words, what you own or lease will carry a different cost structure from what you contract out, but both methods have related costs, including the reduction in total revenues as they are shared with more partners and service providers.

For example, if the organization chooses low cost as its basis of competition, then the supply chain strategy will tend toward efficiency as its cost structure. An efficient supply chain will have economies of scale, will use third parties whenever the total cost is the lowest, and will minimize customer service and expensive sales channels. If the products being produced need a make-to-stock operating model, inventory levels will still be minimized. This model will not be able to emphasize responsiveness, such as ensuring delivery during an emergency, as the level of responsiveness generally has a positive correlation with cost. Therefore, increasing responsiveness increases cost.

On the other hand, if the organization has innovation or customer experience as a basis of competition, its supply chain will likely pursue this focus or differentiation competitive basis by investing in responsiveness, so that it can respond quickly to changes in market conditions, transformative technologies, the need to increase capacity (i.e., agility), new competitors, or the incorporation of newly acquired organizations. In this case, the cost structure will not be able to also maximize efficiency in all areas, as some redundancy and scalable capacity may need to be maintained.

However, with either model, costs will need to be tracked and controlled so that they can be minimized to the extent possible given the strategic goals. Depending upon the type of industry, supply chain costs can be as high as 50 percent of a company's revenues. According to research done by A. T. Kearney, a global consulting firm, inefficiencies in the supply chain can total 25 percent of a company's operating costs. When a company is faced with thin profit margins, like 3 to 4 percent, even a small improvement in efficiency can double profitability. Implementing the appropriate cost-centered or at least cost-aware structure and strategy is critical.

Spend management is one tool that organizations employ to ensure that funds outflows are appropriate and authorized. The *APICS Dictionary*, 16th edition, defines **spend management** as

managing the outflow of funds in order to buy goods and services. The term is intended to encompass such processes as outsourcing, procurement, e-procurement, and supply chain management.

Spend management often deals with consolidating internal demand across business functions, divisions, or extended partners and/or consolidating suppliers to find areas for purchasing and transportation quantity rate discounts. Relative to financial performance, spend management involves managing the outflow of funds in order to buy goods and services. Spend management may also need to coordinate closely with accounts payable, because payment timing is vital to spend management execution.

If supply chain management can reduce the amount spent on inventory or increase the speed with which inventory is

converted into cash without reducing customer service or revenue, then it certainly contributes to the company's financial performance. Saving money will always be a priority; organizations realize a more direct gain when costs go down than when revenues go up. This is because when revenues go up all variable expenses also go up. When sales increase, some costs, such as material and labor costs (called variable costs), increase right along with the sales increases. Accounts receivable also increase, and organizations have more control over inventories than over receivables.

Revenue model

A supply chain's revenue model will parallel its organizational equivalent. Supply chain strategy can enable the establishment of proper sales channels per customer segment by helping to establish regional sales centers at warehouses or distribution centers, for example. A supply chain doesn't directly produce revenues unless the sales channels are included in what is defined as the supply chain. In the past, a supply chain was perceived as a cost center. This mentality led to cost-cutting measures that often compromised value. More modern supply chain revenue models consider the supply chain as a value-added service that earns the organization a share of the revenue it is producing. Supply chain managers need to play a role in justifying supply chain management by promoting it with executives as a value-added function.

Topic 3: Optimization

Reasons misalignments or gaps occur

Certain supply chains are dynamic in nature, particularly in cases where the product or service offering requires responsiveness. A strategy that works today may not be as effective in the future. It is for this reason that the SCOR model measures supply chain flexibility and supply chain adaptability as the two components of supply chain agility. There are several important factors that can cause an organization to need to alter its supply chain strategy:

- Change in market conditions
- Change in business direction
- A disruptive technology
- Anticipated change in market
- A business combination or merger
- Product life cycle changes

We'll look at examples of each factor and the role played by innovation.

Change in market conditions

Changes in market conditions can happen with stunning rapidity. But they can also evolve steadily and incrementally over time. The key is for supply chains to spot these changes early and adapt quickly.

Cisco

A classic example of failure to respond quickly was Cisco Systems' disastrous experience when the dot-com bubble burst. For years Cisco had been the very model of supply chain excellence with its automated workflows and cross-company communications networks that tied it to customers and suppliers alike. But when demand for Cisco's routers plummeted rapidly in 2000 and 2001, the company was stuck with over US\$2 billion of useless inventory. Despite the marvels of its interconnected network, Cisco's suppliers (it outsourced most manufacturing) failed to get the word that demand was vanishing. So the suppliers kept on sending product into inventory. Their interests had slipped out of alignment with Cisco's, with disastrous results.

Nestlé

In a more recent example, retailers selling goods in brick-and-mortar stores in China, including Unilever and Nestlé SA, were hit hard by a fast and sharp drop in retail demand. Overestimated retail demand forced Unilever to post 20 percent drops in both third and fourth quarter 2014 China sales, while, according to a *Wall Street Journal* article from June 2015, Nestlé was burning instant coffee it couldn't sell. The article goes on to state that while Unilever claimed the slowing economy played a role, the trend has much to do with the rapid increase in consumer online shopping.

The rapid penetration of smartphones has significantly increased online shopping in China, to 70 percent per year for the past four years, totaling 461 million online shoppers in 2015—a third of the population. Of these online consumers, half are even buying groceries online. China is now the largest e-commerce market, having overtaken the U.S. in 2013.

While Unilever and other organizations have been selling goods online for some time and are far from laggards in this area, the story highlights how difficult it is to keep a supply chain flowing smoothly when something minor, such as delivery patterns, shifts. Online purchasing has high competition, so not all online sales will be through one organization, even if it does have well-developed e-commerce. While large organizations were once able to negotiate with retailers for preferential display space, as Nestlé's China food and beverage director Reinhold Jacobi says, "If you go online, everyone gets the same screen space."

Zara and Mango

More successful examples are provided by European apparel brands Zara and Mango. In the market for fashionable apparel, change is a given rather than a surprise. Every season can bring a shift in taste that makes all processes, designs, and materials outmoded. So Zara, Mango, and other fashion-conscious clothing companies and brands have found ways to begin the seasonal design process early. By paying careful attention to trends on the street, they can get a head start in ordering materials and developing prototypes of designs that seem likely to appeal to their target customers in the upcoming season. But they delay final design decisions and the start of manufacturing until real data come in.

Change in business direction

Another reason to modify a supply chain strategy arises when a company comes to market in a new way. It may be entering uncharted territory with no real data to use in making decisions and little ability to forecast demand and set production schedules. A new product line may require complete recasting of the supply chain—new raw material supplier, new manufacturing processes, logistics changes to reach new markets, and new strategies for reaching the end customer.

Toyota Motor Corporation faced those challenges when it brought out the Prius, its first gasoline-electric hybrid car. There were no comparable vehicles in the market at the time, so there was no demand history to use in forecasting sales in the aggregate or for segmenting the potential market.

Toyota dealt with the challenge of forecasting by changing its logistics network in the United States to reflect its uncertainty about where it would be delivering the new models and what sort of buyers might be interested in them. They suspected that new market segments might be attracted to the offbeat styling, technical inventiveness, and "green" characteristics of the Prius—customers who were not interested in their more conventional, family-oriented vehicles. Instead of allocating cars to dealers based on past performance, they sent Priuses from the production line to central distribution centers for shipping to dealers only in response to customer orders forwarded from the internet. With the larger pool of cars in central locations, they reduced the risk of stockouts caused by unexpectedly large consumer demand in any one region.

Toyota also allowed for customization of cars at the distribution centers in response to requests for specific features—a postponement strategy made possible by modular design. The system was more expensive, but it provided the required flexibility in delivery. The percentage of the new model sold in northern California far exceeded the usual percentage allocated there, while sales in the southeast were far less than demand patterns for other Toyota models would have predicted. Without the centralized logistics setup, the Prius would no doubt have gone immediately out of stock on the west coast while sitting unsold on car lots in the southeast. So the investment in a new supply chain strategy provided net value when compared with the

probable costs of redirecting cars from the southeast all the way across the country to California and risking the loss of customers due to the resulting delays.

Disruptive technology

New technologies can change the rules of the game and allow new competitors to quickly take market share from an organization if it doesn't recognize the implications of the technology quickly and also adopt it. For example, when Netflix announced that its primary business model would be electronic delivery of movies, its competitor Blockbuster and many others may have scratched their heads, since DVD delivery was the business model Netflix had used to grow so large in the first place. However, their move proved to be prophetic, as their rivals were too late to adopt a similar model. A few years later Blockbuster went out of business.

Anticipated change in market

As the case of the Prius indicates—and to a degree the strategies of Zara and Mango—supply chain strategies can be modified in anticipation of changes in demand rather than waiting until they come as a surprise. This might be considered an advanced form of forecasting, and since forecasts are always wrong, a very risky strategy. A clothing design operation has no choice but to forecast, since it has to anticipate trends in fashion on a continuous basis. If a new look will depend on natural fabrics instead of synthetics (or vice versa), new suppliers will be necessary, and they will have to be under contract before the season begins. Zara and Mango are effective because they are committed to creating a design process that allows for revamping supply strategies at the last possible minute when real data are beginning to replace forecasts.

Toyota's success was due to its innovative approach to the marketplace; in anticipation of new demand patterns resulting from environmental consciousness and the potential impact of rising petroleum prices, the Prius was created. The company was additionally successful because they were proactive in setting up a new supply chain in advance of Prius sales that was suited to an innovative product.

In similar fashion, forward-looking energy companies and utilities have been developing—perhaps far in advance of practical application—alternative energy technologies that will no doubt require the creation of new supply chain infrastructure. Innovation plays a major role in keeping supply chains flexible enough to respond to rapid changes in demand as well as more gradual evolution of markets and technologies. Innovation is the key to strategic flexibility—not just innovation in product design but in organizational design and supply chain processes as well.

Sometimes it's an organization's strengths that make it most vulnerable. Trust in other supply chain partners can cause problems when they are not up-front with changes to their strategies. In addition, supply chain efficiency can become a serious liability if the chain loses its flexibility because they have removed all the buffer from inventories or pared process times down to the Just-in-Time delivery velocity. A supply chain that has become fast and lean may just keep right on running in a given direction until it starves to death for lack of a market.

Business combination or merger

When an organization acquires or merges with another organization, their supply chains may also need to

merge and reconfigure. Some redundancies can be minimized, while other redundancies might be maintained to improve flexibility and reduce risk. A careful review of each function will be needed to see what can be integrated, what is best kept separate, and what needs to be eliminated. Another consideration is customer experience and perception. While some supply chain changes can be made without any impact on the customer, those changes that impact customer delivery times, costs, or even the persons with whom customers are accustomed to working need special consideration before changing.

Product life cycle changes

The product life cycle is addressed in a later section, but, in essence, different supply chain strategies will be needed as products are introduced, as they grow in demand, as they mature or plateau in demand, and as they decline in popularity and other products start taking their place.

Recognizing misalignments or gaps

Does the organization's culture reward or punish failure? When failure is punished and only success is celebrated, managers of all sorts will fear being critics. Unfortunately, critics are just the sort of persons who are needed to point out when a strategy has misalignments or gaps. These gaps will eventually become so obvious that everyone will recognize that they exist. However, by then the impact on organizational market share and other factors will likely be difficult or impossible to repair. An organization can start on the path to becoming a culture that rewards critics for speaking up by using tools such as anonymous surveys or brainstorming meetings where everyone is asked to give five reasons why a given strategy might fail.

Change management will also likely be needed, which is addressed in a later section.

A third-party consultant or organization may also be in a good position to provide an objective analysis of the organization and its gaps. Such an organization, or the organization itself, can use tools such as a SWOT analysis to discover the organization's gaps; these tools are discussed later. Of course, making the decision to act on difficult news takes courage as well, but this is a change that may need to start at the executive level.

Resolving misalignments or gaps

If supply chains are to be able to respond in advance of market changes, they will have to play by different rules than many have in the past. Here are some of the lessons supply chains have learned:

- **Pursue cost efficiencies and increased velocity but not at the exclusion of flexibility.** The strategy of shipping only in full truckloads or full containers cuts transportation costs, but it can also leave a partial load of product waiting at the dock when it should be on the road to a stocked-out facility downstream.
- **Develop multiple supply chains that are appropriate to each product line.** Some companies, to achieve those full truckload shipments, will mix products. While that's a good strategy for speeding up delivery of some products in the mix, it may be highly inefficient for others. The high-dollar, lightweight items could be flown to their destination rather than staying in the truck, train, or container. One can customize suppliers to provide whatever each product line needs—speed to market, quality at a higher price, or ability to change rapidly.

- **Watch trends in demand at the consumer end of the chain, not just at the next stop downstream.** Visibility to the end of the supply chain can speed up response to changes in the market.
- **Watch the larger trends in global markets**—changes in demographics, political changes, patterns in rules and regulations, access to raw materials, and so on. Get local assistance for advice on supply chain strategies when you enter an unfamiliar foreign market.
- **Design products for maximum supply chain flexibility.** Put suppliers on the design team to offer help in creating modular designs, allowing fewer components to be assembled into more products. Time the assembly to happen as close to actual orders as possible.

Aligning with complexity requirements

Another way to address misalignments or gaps is to evaluate the complexity of the supply chain. A supply chain should be only as complex as it needs to be. Complex supply chains take more time and money to establish, monitor, and control, and they become more difficult to keep agile and responsive to changes in demand.

Sources of supply chain complexity include maintaining multiple supply chains for different goods or services, maintaining an extensive asset footprint for production or distribution, the variety of products sold, the amount of configuration needed for products and at what stage, and the number of customization options available to customers.

Limiting product and service offerings is a key way to minimize complexity while maintaining flexibility, since reducing asset footprints or reducing the number of different supply chains will severely impact flexibility and customer experience factors. The Performance Measurement Group (PMG), an internal PwC organization, consists of supply chain performance experts who collect data and perform benchmarking analyses of companies across the globe to assess supply chain performance. Their research indicates that best-in-class supply chains have a similar number of customers and production and distribution assets as their average peer group but roughly 50 percent fewer distinct items for sale (fewer SKU groups). Maintaining only variety that is actually in demand increases flexibility because there will be lower risk of unsold inventory and stockouts.

The question to ask is whether the additional options actually increase sales or just increase inventory. Measurements need to be developed to answer this question before making such changes.

Aligning with supply chain partners

When gaps or misalignments exist between supply chain partners, often this requires determining who the channel master is and how much influence the organization has. If it is the channel master, how sensitively has it used its clout in the past with partners? Are they treated as respected partners, or have they been pummeled for price concessions and controlled? The latter group may be resisting full alignment with the strategy.

Non-dominant players may have more influence with some customers and suppliers than others. The key to segmenting customers and suppliers is understanding if you are in a buyer's or a seller's market. If there are multiple suppliers for a customer, each supplier will have relatively less clout, as is true in the automotive

industry. If you make a key component that few suppliers can duplicate, you will have more influence with your customers, as is often true for innovative technologies. The idea is to use that influence to promote collaboration over control. Collaboration is discussed more in a later section.

Chapter 4: Tools and Techniques

This chapter is designed to

- Explain how to use macro- and microeconomic theories and analyses when developing a supply chain strategy
- Define key financial terms
- Explain key financial statements that are commonly used in supply chain management
- Explain how to use strengths, weaknesses, opportunities, and threats (SWOT) analysis, market research, network modeling and operations research, and balanced scorecards when developing supply chain strategy.

Topic 1: Macro- and Microeconomic Considerations

Reviewing macro- and microeconomic reports or internal analyses can help supply chain managers better understand overall market forces and specific demand characteristics for an organization's products and services. Macroeconomics looks at the behavior of the economy as a whole, while microeconomics looks at the behavior of individuals and firms given changes in prices and resource allocations.

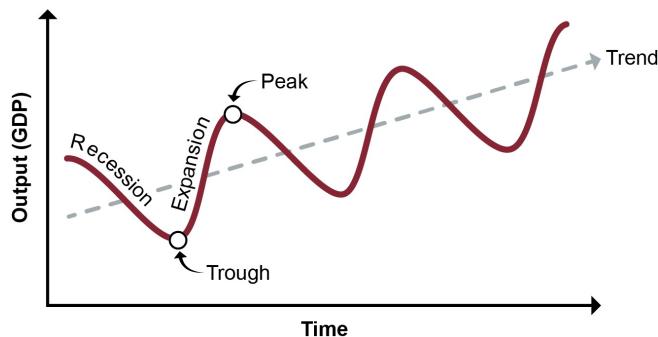
Macroeconomics

Macroeconomics is the analysis of the behavior of the overall economy (supply and demand in aggregate) in response to various market forces. Supply chain managers use information on the trend of the economy by country or region or globally to estimate how this will impact the organization's industry and thus the organization and its supply chain strategies.

Exhibit 1-19 shows how the overall economy goes through cycles between periods of expansion and recession (or depression) in terms of gross domestic product (GDP) over time. The size (amplitude) and duration of each wave can differ significantly from cycle to cycle, and, while the overall trend of the economy over many cycles has historically been upward-sloping, this growth trend is not guaranteed.

Near the peaks of a cycle, unemployment is low and production is at or near full capacity. Near the troughs, employment and output are low. Innovation can trigger periods of expansion; economic scarcity, political events, or financial instability can trigger recessions.

*Exhibit 1-
19:
Economic
Cycles
and
Long-
Term
Trend*



Since these economic swings have such a large impact on supply and demand, economists study them to determine their causes, what shortens or sustains them, and how to promote stability through public policy.

Classical economic theory held that the economy would always correct itself from a recession or depression, thus promoting a *laissez-faire* philosophy. However, economist John Maynard Keynes believed that the sustained cyclical unemployment observed during the Great Depression could not be explained by classical economic theories.

Keynes posited that some part of income produced in any period would always be saved (the classical theories assumed that, on an aggregate level, all income was spent in the same period it was produced and thus didn't account for savings) and that in good economic times some of this savings would be used to buy capital goods. However, when the economic picture looked bleak, organizations would forego investment spending and the savings would not be put to use. (In fact, organizations did hoard cash during the 2008 recession and avoided capital investments.) Keynes theorized that this would create insufficient total spending, which in turn would cause inventory to accumulate. He made a simplifying assumption that prices would remain fixed in his models, which was his observation during the Great Depression. Even though many prices do drop in these times, the model is still useful because the critical reactions to unsold goods in his theory would be reduction of production output and idling of workers, which were indeed the most influential effects observed both in the Great Depression and the 2008 recession. Worker layoffs would result in a recession or depression and thus widespread cyclical unemployment.

Unlike his predecessors, Keynes believed that such situations would not be self-correcting and that governments needed to actively respond, which was the rationale behind the various forms of U.S. and other government stimulus packages and tax cuts during the 2008 recession. When governments instead turn to austerity measures during a recession, as was the case in much of Europe, these actions are often promoted on the basis of the classical *laissez-faire* economic theories. Keynes believed instead that one must spend one's way out of a recession and that austerity measures would only prolong it.

Today's economists differ on fiscal policy. Some believe that an increase in government spending without any increase in taxes and interest rates will increase demand. Other economists believe that increased

government spending also results in increased government borrowing. The theory is that this borrowing "crowds out" other borrowers and decreases demand.

Having a basic understanding of these theories and how current political forces align with them can help supply chain managers modify their strategic plans to reflect the current and predicted future economic conditions.

Real GDP and weighted average price

Real gross domestic product is the total value of all final goods and services produced within a given set of economic boundaries such as a country's national boundaries. Sometimes real GDP is studied against the weighted average price of all products and services sold in the same economy. When overall prices shift higher, people can afford fewer goods and services; when prices are lower, people can afford more. Conversely, and as an opposing force to this effect, when overall prices shift higher, suppliers want to make more; when prices are lower, suppliers will be less motivated to produce and will cut production and idle workers. These two opposing forces work to balance each other out in the long term to a point of equilibrium.

Let's look at the impact of these macroeconomic forces at a few key points in the economic cycle. At the end of a period of growth, weighted average prices will have gone up to the point where people cannot afford as many goods or services. Supply will lag this trend and will be producing as much as they can to take advantage of the high profits that high prices entail. Note that even if demand is extraordinarily high just before this turning point, supply will not be infinitely high as there is a physical limit of an economy, which is the total amount the economy can produce based on the scarcity of labor and materials and diminishing returns created by ever-increasing business expenses. The high supply and low demand will generate a surplus of goods, which will further reduce profitability. Plant closings and layoffs will occur, helping to trigger a recession. Weighted average price will fall and the economy will work toward equilibrium, but perhaps the pendulum will swing beyond this point.

At the tail end of a recession, weighted average price will be low and so demand will be high. Even though suppliers will be less motivated, they will still be motivated to produce some amount of goods because labor will be plentiful and cheap and because they have equipment and other overhead that is costing them money regardless of whether or not they produce anything. So supply will start to rise. As long as the weighted average price stays relatively low, there will be high real GDP and a period of recovery will begin. During this period there may be shortages because aggregate demand outstrips supply, which will tend to increase prices and bring the economy toward equilibrium and perhaps beyond.

During the strong part of a growth phase, prices will be relatively low and total real GDP will be high, because there is more real wealth and thus more consumption spending. Real GDP will also be high, in part because as more money is circulating, interest rates fall, which increases capital spending. As the economy prospers but has not yet raised prices beyond the point people can afford, the point of equilibrium will be reached. The point of equilibrium will also be the point of full employment for the economy being studied. Full employment is when the only unemployment is from frictional or structural sources, where frictional refers to normal unemployment such as new college graduates looking for work and people between jobs, and structural refers to changes in the structure of available work (i.e., workers who need retraining because their skill sets are obsolete). The potential output of the area's economy at full employment is also called the long-

range aggregate supply.

Interpreting macroeconomic information

Macroeconomic information cannot be directly applied to one industry's or one company's products. These are trends of all goods in the economy in the aggregate. How do economists put this and other macroeconomic information to practical use?

Changes in the macroeconomic environment, such as a market adjustment (e.g., the correction in prices for homes when the housing bubble burst in 2008), have effects that can be predicted using economic models. Other factors, such as population demographics (e.g., a higher proportion of adults in retirement age), can also have a predictable impact. In general, factors that reduce household wealth will reduce demand since consumers will have less to spend. This can include tax increases or credit availability. Market interest rates are also a factor. When they are low, businesses have an incentive to borrow to make capital investments and start projects because the return on investment is promising; they avoid these investments when rates are high.

Similarly, if a country's net exports increase, aggregate demand increases, and vice versa. Export levels can change due to changes in exchange rates (depreciated currencies increase aggregate exports and demand, while appreciated currencies reduce them) or when other countries increase their GDP and have more wealth to spend.

Note that if input prices (e.g., the cost of goods sold) increase, supply will decrease. If raw materials become scarce, supply will decrease, but abundance of materials increases supply. Similarly, an increase in taxes or regulatory costs decreases supply. (Some argue that deregulation might increase supply in the short term but social and environmental costs could increase long-term costs and decrease supply.)

An increase in productivity relative to inputs will result in larger real GDP levels at any price. (On a curve mapping short-term aggregate supply, the entire curve would shift to the right or toward higher real GDP levels.) This could be due to a new technology or better-educated workers.

Inflation and deflation

Inflation is a sustained increase in the general level of prices for an area, while deflation is a sustained decrease in prices. One way to detect inflation is with a consumer price index (CPI), which is a sampling of the actual prices of various consumer goods. Inflation occurs when consumers have more money available to spend but the supply is scarce. Creditors are harmed by inflation; debtors are helped. Inflation also harms consumers on fixed incomes.

A primary purpose of government central banks is to control inflation. A very small amount of steady inflation is desired (to minimize the risk of deflation), but high inflation or deflation needs to be prevented. From a macroeconomic perspective, the goal is noninflationary growth in real GDP. This occurs when short-term aggregate supply and long-term aggregate supply and demand all increase. Prices remain stable while real GDP increases. Inflationary growth in real GDP occurs when demand increases but supply fails to increase as fast. Deflationary growth in real GDP occurs when demand increases but supply increases faster than demand.

Recessions and depressions

A recession is when real GDP declines for two consecutive quarters. If the long-range aggregate supply decreases during that time or if the contraction is severe or prolonged, it becomes a depression.

Metrics

Supply chain managers need to scan the macroeconomic environment for multiple countries and economic regions. In addition to reviewing trends on the consumer price index, the consumer confidence index (CCI) provides leading information on likely future demand because it polls consumers' feelings about the economy and how likely they are to make purchases. (Modern economics accounts for the strong influence of often irrational human emotions, while in the past it focused on purely rational decision making.) Another index of value is the producer price index (PPI). The PPI measures the prices received by domestic producers for their goods and services, which can help indicate producers' opinions of the economy. PPI can also help when determining how to set contract terms. Indices such as these may be known under different names in different countries, and some countries may have more historical data available for comparison than others. The methods of collection may also differ, so values for different countries may be more or less comparable.

Globalized sources of information are especially important for supply chain managers, since they buy and sell in so many different countries. For example, the World Bank provides "Worldwide Governance Indicators" for 215 global economies. (This resource can be found in our online Resource Center.) These key performance indicators track fairness of elections, rule of law, control of corruption, and other transparency and effectiveness measures. They also track the growth trends of GDPs.

In addition to GDP, the World Bank and other sources such as the International Monetary Fund and the World Trade Organization publish economic indicators such as gross national income; government surpluses, deficits, and indebtedness; consumer savings; and foreign investment. Government agencies publish metrics for their specific countries. Privately funded research organizations publish economic outlooks. Large organizations may have consultants or in-house economic experts on staff. Risk management business units may also have compiled economic reports and analysis that are available for review.

Microeconomics

The 16th edition of the *APICS Dictionary* defines **microeconomics** as "the analysis of the behavior of individual economic decision makers (individuals and firms)." Microeconomics focuses on specifics such as the price of a product, how sensitive customers are to changes in that price (how much price changes impact demand), cost trends for a business, or employment levels in a given industry. Supply chain managers can use microeconomic theories and models to determine when or where to expand output, what product mix to have where, when to raise or lower prices, and so on.

Supply and demand on a microeconomic scale

Since we are now talking about individual rather than aggregate supply and demand, some economic laws come in to play.

- **Law of demand.** The law of demand states that as the price of a good or service increases, demand

will decrease (all things being equal).

When mapping supply and demand on curves, as price goes up, demand goes down. This is called the elasticity of demand. The elasticity of demand relies on economic assumptions about scarcity and the use of pricing in an open market. Scarcity means that goods and services are limited in availability, so businesses and consumers need to make choices about what goods and services they want more than others. Pricing is an efficient mechanism for distributing scarce resources. It creates a system of rationing, or doling out of those resources to entities who want them enough to pay more for them than others. These choices create opportunity costs. Opportunity costs are the other things that the entity is sacrificing to make the chosen good or service a priority.

This is the simplified view of microeconomics. However, the marketplace is diverse, and there are goods and services that might be almost as good as the desired scarce item. These are called substitute goods. The substitution effect states that the prices of substitute goods are interrelated. As the price of one good increases, consumption of the substitute good may increase. The most cost-effective choice is selected when substitutes exist. With this in mind, the law of demand can be viewed in relative terms. If the organization lowers its prices but its competitors lower their prices more, consumer expectations will shift and the organization effectively has had a price increase.

Additional forces reinforce the law of demand. The income effect increases demand at low prices. As prices go down, persons or organizations with limited funds will be able to buy more units. A related force is diminishing marginal utility. When consumers purchase units of a good or service, each additional unit purchased will have less utility than the previous one.

- **Law of supply.** The law of supply states that as the price of a good or service increases, supply will also increase. More sellers can sell at a profit.

Higher prices give producers more incentive to produce and sell goods so they will make more supply available. For example, the central United States fracking oil boom created several years of explosive growth in the Midwest. When market oil prices plummeted in 2015, the number of new oil development projects also plummeted, even though the developers had the drilling rights. When oil prices rise again, these developers will have an incentive to resume drilling.

Two other microeconomic concepts related to supply are economies of scale and diminishing returns. Economies of scale means that as output is increased, the cost per unit of output decreases because all fixed costs (like overhead) are spread over a larger number of units. At a certain level of output, however, an organization may experience diminishing returns, or diseconomies of scale. This occurs when new costs are incurred to increase output, and these new costs can cause the cost per unit of output to slow its decrease until it is no longer valuable to produce additional units.

- **Equilibrium.** Just as supply and demand on an aggregate scale tend toward equilibrium, so do individual prices. The **law of supply and demand** states that the price of any good will adjust until the quantity supplied and quantity demanded are in balance. A surplus will result in price cuts to sell off the excess inventory, while a deficit will result in price increases as the scarcity of the offering demands higher prices. Some goods will adjust to equilibrium faster than others.

Price elasticity

Price elasticity of demand

As household wealth rises, demand for some products will increase a great deal and others less so. Price elasticity of demand assigns a level of elasticity to various products. The 16th edition of the *APICS Dictionary* defines **price elasticity** as

The degree of change in buyer demand in response to changes in product price. It is calculated by dividing the percentage of change in quantity bought by the percentage of change of price. Prices are considered elastic if demand varies with changes in price. If demand changes only slightly when the price changes, demand is said to be inelastic. For example, demand for most medical services is relatively inelastic, but demand for automobiles is generally elastic.

Innovative products like smartphones are elastic because they rise or fall strongly in demand as price changes. Staple products like eggs are inelastic because they may not have much increase or decrease in demand as price changes. In general:

- Low-priced items are generally inelastic and are less impacted by small price changes.
- Necessities are inelastic and luxuries are elastic.
- Demand is more inelastic over the short term and more elastic over the long term (e.g., people pay more for gas for a while but may shift to a more efficient vehicle or the bus if prices stay high for a while).

Supply chain managers can look up or calculate the price elasticity coefficients for their products and services. There are a number of ways to calculate the price elasticity coefficient, but a simple test is the total revenue test. If you drop the price and demand increases, and if the loss of revenue from the lower price is exceeded by the increase in revenue from more units sold, then demand is elastic. However, if you drop the price and the loss of revenue from the lower price is greater than the gain in revenue from the increase in unit sales, then demand is inelastic. A coefficient greater than 1.0 is elastic; less than 1.0 is inelastic. These coefficients tend to hold true over a particular price range. However, at a higher or lower price point, a good or service may shift from being inelastic to elastic or vice versa.

For example, consider the two products in Exhibit 1-20.

*Exhibit
1-20:
Price
Elasticity
of
Demand
Example*

Product A

Price/ Unit	Margin/ Unit	Demanded	Price Elasticity Coefficient	Elastic?	Revenue	Margin
\$120	\$40	1,000	n/a	n/a	\$120,000	\$40,000
\$110	\$30	1,100	-1.2	small	\$121,000	\$33,000
\$100	\$20	1,300	-2	small	\$130,000	\$26,000
\$90	\$10	1,600	-2.31	small	\$144,000	\$16,000

Product B

Price/ Unit	Margin/ Unit	Demanded	Price Elasticity Coefficient	Elastic?	Revenue	Margin
\$120	\$40	1,000	n/a	n/a	\$120,000	\$40,000
\$110	\$30	2,000	-12	big	\$220,000	\$60,000
\$100	\$20	4,000	-11	big	\$400,000	\$80,000
\$90	\$10	7,500	-8.75	big	\$675,000	\$75,000

Both products have the same characteristics for price per unit and margin per unit. The cost of goods sold is deducted. This shows that as the price goes down, so does profitability. However, the top example is a little elastic (demand goes up steadily as prices fall) while the bottom is highly elastic (demand skyrockets as prices fall). The elasticity coefficients are calculated for all but the first line of each example because the calculation requires a prior price/unit and prior demand amount in the calculation. (Row 5 uses rows 4 and 5 in its calculation, and so on.)

In the top example, the US\$120 per unit price would provide the highest gross margin, so it would be the best choice of the options shown. (Choosing based on revenue would be an error.) However, in the bottom example, a price of US\$100 per unit would provide the highest gross margin.

From a supply chain management perspective, if the logistics costs are subtracted as part of the margin per unit calculation (i.e., included in the cost of goods sold), then these are the correct calculations. If however, logistics costs are omitted from the analysis, the actual highest profit price point could be quite different.

When analyzing economic tradeoffs of different prices and demand, all influencing costs need to be included.

Price elasticity of supply

Price elasticity of supply shows how sensitive suppliers are to changes in product price. Over the short term, suppliers will continue to supply products at lower prices, so they are inelastic in the short term, but over time they will shift away from these products to produce products with higher profit margins, so over the long term, supply is elastic.

Marginal analysis

Another microeconomic concept is marginal analysis. A marginal analysis focuses only on the marginal utility and marginal cost of the choice. Marginal utility is the extra usefulness or satisfaction gained from purchasing one additional unit of the good or service. Marginal cost is the additional cost incurred for making a given decision or the cost of producing one more unit of a good or service. Costs incurred regardless of

what choice is made are ignored. The rule for marginal analysis is that if the marginal utility exceeds the marginal cost, it is a wise economic choice.

For example, if it costs €1,000 to move one truckload of freight between two major cities and a truck can haul 10,000 kilograms of freight, the average cost is $\text{€1,000}/10,000\text{kg} = \text{€0.10/kg}$. Should an offer to fill in some unused space in the truck for €0.05/kg be rejected? Using marginal analysis, one considers only the marginal costs and benefits. The marginal costs are a small amount of additional fuel to ship the increased weight and a trivial amount of added wear and tear on the vehicle, plus the fuel and driver mileage to another loading and unloading point and time spent in loading and unloading the other cargo. The rest of the driver's time, all insurance, and so on are already included in the planned trip cost, so these are ignored. They are sunk costs for purposes of this decision because they will be incurred regardless of the choice made here. If the marginal cost for this new freight is €0.02/kg, then the added €0.03/kg is a marginal net benefit.

Accepting the offer is the rational economic decision.

This concept of utility can drive supply chain design decisions as well, such as whether a facility or process is adding value in the eyes of the customer.

Applying macro- and microeconomic information

Supply chain managers can use this information to shape an opinion of how disruptive forces in the environment might impact the demand curve for the organization's specific products and services and thus set a strategy that compensates for weaknesses and capitalizes on strengths. If the supply or demand curve for a product shifts, analysts at the organization can predict the new equilibrium point for the product and then calculate profit margins assuming the market price reaches this point. Knowing the likely selling price of the product can help when setting cost goals for supply chain activities. Finally, they can use marginal analysis to make rational daily decisions for logistics or other areas of the supply chain.

Topic 2: Accounting and Financial Reporting Information

Cost accounting addresses core production costs; financial statement analysis covers these as well as other organizational costs. Being able to interpret organizational accounting and financial reporting information can help supply chain managers develop an understanding of the current state of the organization's finances.

Cost accounting

According to the *APICS Dictionary*, 16th edition, **cost accounting** is

the branch of accounting that is concerned with recording and reporting business operating costs. It includes the reporting of costs by departments, activities, and products.

A related term to cost accounting is management accounting. Cost accounting is used to calculate the costs that will be reported on the organization's external financial statements and to tax authorities. Management accounting is used for internal management decision making and doesn't need to conform to external reporting or tax accounting rules. While cost accounting is backward- or historical-looking, management accounting is forward-looking (budgets and forecasts).

A basic understanding of how costs are managed internally by the organization can help supply chain managers determine a complementary cost structure for the supply chain. One common method of cost accounting is standard costing.

Standard costing

According to the *APICS Dictionary*, 16th edition, **standard costs** are

the target costs of an operation, process, or product including direct material, direct labor, and overhead charges.

The *Dictionary* defines a **standard cost accounting system**, or standard costing, as

a cost accounting system that uses cost units determined before production for estimating the cost of an order or product. For management control purposes, the standards are compared to actual costs, and variances are computed.

Standards are targets that the organization sets to show the expected or desired outcome of an activity. These are periodically reviewed and changed as needed.

To understand standard costing, some additional terms from the *APICS Dictionary*, 16th edition, should also be introduced.

Cost of goods sold (COGS): An accounting classification useful for determining the amount of direct materials, direct labor, and allocated overhead associated with the products sold during a given period of time.

Current price: The price currently being paid as opposed to standard cost. (A related term is market price, which is the going price for an item on the open market.)

Usage variance: Deviation of the actual consumption of materials as compared to the standard.

Cost variance: In cost accounting, the difference between what has been budgeted for an activity and what it actually costs.

Standards are set for each of the elements of the cost of goods sold. Each cost has two components that are set as standards: volume and rate.

Cost =	Volume	x Rate
Direct Materials Cost =	Quantity Purchased	x Unit Cost
Direct Materials Used =	Quantity Used	x Unit Cost
Direct Labor Cost =	Standard Hours	x Hourly Rate
Overhead Cost =	Cost Driver	x $\frac{\text{Total Overhead}}{\text{Total Cost Driver}}$

Volume is how many units of a resource are purchased or used, and rate is the cost per unit of that resource.

When volume has variances from the standard, it is a usage variance; when the rate has variances, it is a cost variance. Both variances are tracked separately, and their sum should equal the total variance.

Variances can be positive or negative. Negative variances occur when costs are greater than expected; positive variances occur when costs are less than expected.

Note that the quantity of materials for an operation has standards both for what should be purchased and what should be used, since these quantities may differ due to factors such as scrap in an operation or quantities for bulk discounts.

Note also that overhead costs are allocated based on a cost driver. A cost driver is simply a measurable aspect of an operation that is used to approximate how much of the overhead should be associated with the units produced. The rate is the total expected overhead for the period divided by the total of the expected cost driver for all operations at that site for the period. A frequently used cost driver is direct labor hours. For example, during a given period:

- An operation to make 30,000 units is expected to use 1,500 direct labor hours.
- All operations in the plant are expected to use 15,000 direct labor hours.
- Total overhead costs for the plant are expected to be US\$300,000.
- The overhead rate is $\text{US\$300,000} / 15,000 \text{ hours} = \text{US\$20}/\text{direct labor hour}$.
- The standard overhead cost for the 30,000-unit operation is $1,500 \text{ hours} \times \text{US\$20/hour} = \text{US\$30,000}$ (one-tenth of the total overhead cost).

The following shows the variance calculation for actual results:

- Actual overhead cost for 30,000-unit order: $1,300 \text{ hours} \times \text{US\$21/hour}$ (a rate determined only at the end of the period) = US\$27,300.
- Variance: $\text{US\$30,000} - \text{US\$27,300} = \text{US\$2,700}$ positive overall variance (less cost than expected), made up of a large positive variance from lower labor hours than expected and a smaller negative variance (higher cost than expected) from the higher actual overhead rate.

Standard costs and variances for direct materials and direct labor would be similarly calculated and accounted for, except that the actual costs may be known during or before production.

Standard costing is used to estimate the cost of goods sold before all costs are known with certainty. It also provides benchmark targets for use during production. Thus it is a method of controlling a process during production rather than only being applied by accounting after production is complete. When variances are detected as they occur, process controls can sometimes keep negative variances from continuing to expand or can prevent the problems from recurring in a later operation. Management and accounting should exercise a high level of control over variances, because this is the key to avoiding period-end surprises that impact financial results.

Note, however, that variances can occur simply because standard costs need to be revised. Depending on how fast or how volatilely material, labor, and overhead prices are changing, organizations may need to revise their standard costs annually, quarterly, or even monthly.

Many of the concepts discussed in these modules make use of standard costing. Inventory can be valued using standard costing (although other methods also exist).

If standard costing is used at an organization, efficiency can be calculated using a formula:

$$\text{Efficiency} = \frac{\text{Standard Hours of Work}}{\text{Hours Actually Worked}} \times 100\%$$

For example, a work center that produces 110 standard hours of work while operating for only 100 hours has an efficiency rate of 110 percent. This is where supply chain management comes into play. It is used to bring a synergy for all the entities in the supply chain and to enable them to operate and produce more efficiently, whether this means optimizing production, storage, or movement capacity.

The effectiveness and efficiency of supply chain management are partly measured by its contribution to the bottom line, and financial statement analysis can provide this information.

Analysis of financial statements

Financial statements help managers and investors track the financial results of an organization's activities.

Whenever you are discussing supply chain financials, remember that each department in an organization has its own particular priorities based on its activities, and those priorities may compete with each other. For instance, the primary objective of marketing is to maintain and boost revenue, and it strives toward that by providing great customer service. Although the finance function is also interested in increasing revenues, its primary focus is on keeping costs and investment expenses low. Production wants the lowest operating costs it can achieve. Those conflicting viewpoints may spill over into how each function views financial documents and metrics.

Accounting standards

Accounting standards are an important factor in creating financial statements. While supply chain managers do not need to know the details of these standards, a brief overview will help in understanding how doing business in multiple areas with conflicting accounting standards will increase costs due to multiple reporting requirements.

The majority of the world uses one set of financial accounting standards, the International Financial

Reporting Standards (IFRS) developed by the International Accounting Standards Board (IASB). A few countries permit rather than require use of these standards, and a few others use country-specific standards, including the U.S.

International Financial Reporting Standards

The APICS Dictionary, 16th edition, defines the **International Financial Reporting Standards (IFRS)** as follows:

A common global language for business affairs so that company accounts are understandable and comparable across international boundaries. As a result of growing international shareholding and trade, they are rules to be followed by accountants to maintain books of accounts which is comparable, understandable, reliable, and relevant as per the users internal or external.

As of 2015, 112 countries had fully adopted IFRS for all or most of their domestic publicly accountable organizations, and others were in the process of doing so. Some countries require IFRS for financial institutions but not listed companies, and others permit rather than require it.

IFRS is a principles-based accounting system, meaning that it presents simple accounting and disclosure requirements and expects organizations to live up to the principle being set down rather than presenting more detailed rules. The argument in favor of principles-based accounting is that promulgating rules provides an incentive to find loopholes and exceptions and workarounds, while principles do not provide this incentive. The organization and regulators can assess whether the entity is operating within the “spirit” of the principle or not. However, ethics violations have occurred under IFRS.

IFRS and U.S. GAAP both allow businesses to organize as proprietorships, partnerships, and corporations, but the most advantageous business form may differ by country, not only due to differences in the country's required accounting rules but also to other country-specific legal and tax differences.

The IFRS financial statements include the following. Since IFRS financial statements are very similar to U.S. GAAP financial statements, naming differences are called out in parentheses.

- A statement of financial position at the end of the period. (This is similar to the balance sheet presented in Exhibit 1-21.)
- A statement of comprehensive income for the period. (This is similar to the income statement presented in Exhibit 1-22.)
- A statement of changes in equity for the period. (This is similar to a U.S. GAAP statement of retained earnings, which is not presented in these materials.) This statement breaks down changes in equity, including shares purchased, held, or sold.
- A statement of cash flows for the period. (This is similar to the statement of cash flows shown in Exhibit 1-23.)
- Notes and explanations of significant accounting policies and so on. (U.S. GAAP also requires notes such as these.)
- A revised statement of financial position as soon as possible if there were significant changes in accounting policy. (U.S. GAAP has this same revision policy.)

IFRS statements report on assets and liabilities, equity, income (called revenue in U.S. GAAP), and

expenses using simple principle-based definitions. (By contrast, U.S. GAAP uses rules-based definitions that are slightly more complex and legalistic.) Here are the IFRS definitions of the major financial statement components:

- **Assets.** A resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity.
- **Liabilities.** A present obligation of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits.
- **Equity.** A residual interest in the assets of the entity after deducting all its liabilities.
- **Income.** Increases in economic benefits that result in increases in equity (other than those related to contributions from shareholders). Income includes both revenues (resulting from ordinary activities) and gains.
- **Expenses.** Decreases in economic benefits that result in decreases in equity (other than those related to distributions to shareholders). Expenses include losses that are not the result of ordinary activities.

Country-specific accounting regulations

A number of countries, including the U.S., use country-specific accounting regulations.

The U.S. generally accepted accounting principles (U.S. GAAP) use rules-based accounting, meaning that the standards for accounting are detailed and specific. The intent is to ensure that all of the details are addressed. However, as noted above, a drawback to this system is that organizations can operate within the rules while still finding loopholes to exploit, which can mean that organizations might be less transparent than the rules intend. Like the IFRS system, rules-based accounting has had its share of accounting scandals.

While the broad strokes of IFRS and U.S. GAAP are very similar, there are numerous small differences in what is allowed and what is not allowed in accounting. For example, under U.S. GAAP a disaster at a plant that is not expected to recur may be classified as an extraordinary item, which means that gains or losses from the event are not classified as part of normal operating revenue or expenses. Under IFRS all income and expense is considered ordinary; there is no such thing as an extraordinary item. The effect of significant unusual events would be handled as part of disclosures in the notes.

The U.S. GAAP financial statements (primarily the balance sheet, the income statement, and the statement of cash flows) are very similar to the IFRS financial statements. The statements have different, but complementary, functions.

Conflicting accounting standards can increase costs due to multiple reporting requirements. However, these costs are decreasing. Most of the countries that do not use IFRS or only partially adopt it are working toward convergence of their standards with the international standards. In addition, the need to reconcile international standards with country-specific standards (i.e., produce two sets of statements) is lessening. For example, the U.S. no longer requires foreign companies that trade shares in the U.S. to reconcile their accounting with U.S. GAAP.

Next, we'll take a closer look at each of the U.S. GAAP financial statements, define some key terms, and discuss some key relationships among the elements of the statements.

Balance sheet

The *APICS Dictionary*, 16th edition, defines the **balance sheet**, or statement of financial position, as “a financial statement showing the resources owned, the debts owed, and the owners’ share of a company at a given point in time.” The balance sheet is often called a “snapshot” of the company’s financial position, because it is a static view of financial value or net worth at a point in time, usually the last day of the fiscal or calendar year, though it could also be for the end of any reporting period, such as a month or quarter. It gets its name from the fact that it has two major sections that have to be in balance—assets on the one hand and liabilities and owners’ equity on the other.

The accounting equation defines this balance; it states that:

$$\text{Assets} = \text{Liabilities} + \text{Owners' Equity}$$

The balance sheet sections are always in balance because owners’ equity is simply the difference between assets and liabilities. An organization uses investments from owners (e.g., shareholders) and amounts owed to others (e.g., bank debt) to acquire assets that are expected to generate a return greater than the amount invested. Owners’ equity can increase or decrease if the organization generates a positive or negative return. The balance sheet shows the increases or decreases in assets, liabilities, and owners’ equity from year to year.

Exhibit 1-21 shows a sample balance sheet for a publicly traded company.

One purpose of the balance sheet is to show whether the organization has increased or decreased its owners’ equity during the year. This is done by comparing the current year’s amounts to the amounts in prior years. Note that in Exhibit 1-21, the size of the owners’ equity has increased in 2015 from 2014, based entirely on profits that were reinvested (retained earnings) rather than from new owner investments. (Common stock and additional paid-in capital are unchanged.)

The value of inventory as presented on the balance sheet may not match the value of inventory used by supply chain managers for internal control purposes. This is because there are a number of ways accounting rules may allow for inventory to be presented for purposes of external financial reporting. The 16th edition of the *APICS Dictionary* defines **inventory valuation** as

the value of the inventory at either its cost or its market value. Because inventory value can change with time, some recognition is taken of the age distribution of inventory. Therefore, the cost value of inventory is usually computed on a FIFO basis, LIFO basis, or a standard cost basis to establish the cost of goods sold

*Exhibit
1-21:
Sample
Balance
Sheet
Showing
Two
Years of
Results*

What the organization owns	BALANCE SHEETS		Statement of financial value at a point in time (end of year)	In Millions (000,000)	
	December 31,			Year 2	Year 1
Assets expected to be converted to cash within one year	Assets				
	Current Assets				
	Cash and Cash Equivalents		\$96.5	\$56.3	
	Inventory		59.9	60.4	
	Accounts Receivable		48.4	44.3	
	Total Current Assets		204.9	161.1	
Long-term assets not easily converted to cash					
Amounts owed to others	Fixed Assets				
	Gross Property, Plant, and Equipment		70.0	60.0	
	Less: Accumulated Depreciation		12.1	7.5	
	Net Property, Plant, and Equipment		57.9	52.5	
Amounts owed this year	Total Assets		→ \$262.8	\$213.6	
Amounts owed beyond one year	Liabilities				
Funds from owners and operations (what is left after liabilities are deducted)	Current Liabilities				
What owners have contributed	Accounts Payable		20.0	19.6	
Reinvested funds from operations	Short-Term Notes Payable		7.5	6.0	
	Total Current Liabilities		27.5	25.6	
	Long Term Liabilities				
	Long-Term Debt		60.0	60.0	
	Total Liabilities		87.5	85.6	
	Owners' Equity				
	Common Stock (Par Value)		11.0	10.0	
	Additional Paid-In Capital		66.0	54.0	
	Retained Earnings		98.3	64.0	
	Total Owners' Equity		175.3	128.0	
	Total Liabilities and Owners' Equity		→ \$262.8	\$213.6	

FIFO stands for first in, first out, while LIFO stands for last in, first out, and each refer to whether the oldest inventory purchased is considered to be sold first when a sale is made or whether the newest inventory is sold first. A commonly used method for inventory valuation is average costing, where the costs for all items are summed and averaged.

Once an inventory valuation method is chosen, the organization should keep it the same for a number of years so that stakeholders can compare the results of different time periods. The accounting method chosen may have nothing to do with actual inventory movement policy.

Note that IFRS bans the use of LIFO.

Inventory on the balance sheet and property on the income statement can be impacted by obsolescence.

According to the APICS Dictionary, 16th edition, **obsolescence** is

- 1) The condition of being out of date. A loss of value occasioned by new developments that place the older property at a competitive disadvantage. A factor in depreciation. 2) A decrease in the value of an asset brought about by the development of new and more economical methods, processes, or machinery. 3) The loss of usefulness or worth of a product or facility as a result of the appearance of better or more economical products, methods, or facilities.

When inventory is obsolete, it must be sold at a discount or written off and removed from the financial statements. As plants and equipment become obsolete over time, they are depreciated, as will be discussed below.

The balance sheet can also be used as a source for a number of financial measurements used in part to measure the success of supply chain activities. For example, the balance sheet lists accounts receivable and accounts payable. According to the *APICS Dictionary*, 16th edition, **accounts receivable** are

the value of goods shipped or services rendered to a customer on which payment has not yet been received. Usually includes an allowance for bad debts.

Accounts payable are “the value of goods and services acquired for which payment has not yet been made.” These two balance sheet amounts are used to calculate the cash-to-cash cycle time, which measures how many days the organization’s working capital is invested in managing the supply chain. **Net working capital** is “the current assets of a firm minus its current liabilities.” Working capital is important to the supply chain because these are the funds the organization has readily available to invest in normal operations.

Income statement

The *APICS Dictionary*, 16th edition, defines the **income statement**, or statement of comprehensive income under IFRS terminology, as “a financial statement showing the net income for a business over a given period of time.”

In contrast to the balance sheet, the income statement is cumulative and dynamic, meaning that the statement covers business results over a period of time, such as a quarter or a year, rather than being a static snapshot. The income statement shows managers, investors, and creditors whether the company has made or lost money during the given period of time.

The basic equation for the income statement is:

$$\text{Income} = \text{Revenues} - \text{Expenses}$$

These are the key terms to be familiar with, all of which can be impacted by the effectiveness and efficiency of a supply chain:

- **Profit** is money remaining from revenues after deduction of certain expenses.
- The **profit margin**, which measures the degree of financial success for a business, is “the difference between the sales and cost of goods sold...sometimes expressed as a percentage of sales” (*APICS Dictionary*, 16th edition).
- The **gross [profit] margin** measures “the difference between total revenue and the cost of goods sold” (*APICS Dictionary*, 16th edition).
- **Net profit** is figured by deducting all expenses, not only the cost of goods sold, from revenues.

Exhibit 1-22 shows a sample income statement, with some explanations in the margin.

Supply chain managers can use an income statement to determine the effect of supply chain expenses on net income. For example, for a manufacturing organization, the direct materials expenses listed in the statement would consist primarily of raw material expenses, so reducing this type of inventory would reduce overall expenses, directly increase profits, and likely increase owners’ equity on the balance sheet. The discussion of the uses of financial statements in regard to inventory is continued in a later section on inventory.

Note that operating expenses such as sales bonuses or general and administrative expenses (all costs that cannot be linked to specific units sold) are called period costs because they must be expensed in the period in which they are incurred. COGS are called product costs. Product costs are accounted for in the period in which the units are sold even though many of these costs may be incurred in earlier periods.

Exhibit 1-

22:

*Sample
Income
Statement
Showing
Two
Years of
Results*

INCOME STATEMENTS		(000,000s) except per share amts.	
For the Years Ending		Year 2	Year 1
Revenue (Sales)	Profit or loss over a period of time	\$302.6	\$276.9
Revenue – COGS = Gross Profit		38.3	37.6
General expenses from running business that cannot be directly linked to specific units of goods/services sold		101.5	99.7
Lowers fixed asset value for taxes		26.6	26.1
Payments on debt		166.4	163.4
Shows effect of taxes on profits		136.2	113.5
Gross Profit – Operating Expenses			
– Depreciation		30.3	24.9
– Interest Exp.		27.2	22.2
– Income Taxes		12.1	8.3
Net Income (Profit) Before Taxes		69.6	55.4
Less: Income Taxes	The "bottom line"	4.6	4.0
Net Income (Profit)		3.9	3.9
Net Income (as a Pct. of Revenue)		58.1	50.3
Net Income Per Share-Basic		16.3	14.1
		\$41.8	\$36.2
		14%	13%
		\$3.95	\$3.78

A final concept of importance to the income statement is matching. Matching refers to reporting related revenues and expenses together in the period in which they were incurred. For example, sales expenses incurred to make a sale should fall in the period in which the sale was made. When they do not, accountants use adjustments called accruals to account for the period differences.

Note the text “The ‘bottom line’ ” near the bottom in the exhibit. This refers to the line at the bottom of the income statement that shows a net profit or loss. Note also that the economic perspective of the triple bottom line, introduced earlier, is a reference to this financial bottom line.

Statement of cash flows

The APICS Dictionary, 16th edition, defines the **statement of cash flows (funds flow statement)** as “a financial statement showing the flow of cash and its timing into and out of an organization or project [over a given period of time].” The statement of cash flows shows the sources of a company’s cash flows and how these cash flows are used. Within a cash flow statement, there are three sections of cash flows: operating, investing, and financing.

The most popular method of calculating a statement of cash flows is called the indirect method. With the indirect method, the operating activities section will show net income (called after-tax net income in Exhibit 1-

23) from the income statement followed by a number of necessary adjustments to convert the total net income to the cash impact of all business activities for the period.

According to the *APICS Dictionary*, 16th edition, **cash flow** is

The net flow of dollars into or out of the proposed project [organization]. [It is] the algebraic sum, in any time period, of all cash receipts, expenses, and investments.

There are three factors that determine cash flows: sales, after-tax operating profit margins, and capital requirements. Some organizations consider cash flow to be a better long-term indicator of financial health than net income.

The purpose of a statement of cash flows is to show lenders, investors, and creditors whether the organization has sufficient cash to pay debts, bills, and dividends to owners, because cash, not net income, is needed to make these payments.

The after-tax net income on the income statement is not the same as cash flow, but it is the starting point for the statement of cash flows. The statement adjusts this amount by increases or decreases in certain accounts to show whether the cash balance has increased or decreased in the period.

Being able to read and understand a cash flow statement is important:

- In order to keep the cash flow turning over, the supply chain professional must efficiently manage the company's inventory level and cost while maintaining and improving customer satisfaction.
- It shows if the company is generating enough cash to fulfill its minimum obligations to lenders, investors, and governments (taxes).
- Generating extra cash can be used to repay debt, purchase additional assets for growth, or invest in new products.

This information is particularly helpful for financial managers, who use it along with a cash budget when forecasting their organization's cash positions.

Exhibit 1-23 shows a sample statement of cash flows using the indirect method.

Exhibit 1-
23:
Sample
Statement
of Cash
Flows
Showing
Two
Years of
Results

CASH FLOW STATEMENTS		In Millions (000,000)	
Year	Change in cash balance over a period of time	Year 2	Year 1
Operating Section			
After-Tax Net Income		\$41.8	\$36.2
Depreciation Add-Back		4.6	4.0
(Increase)/Decrease in Inventory		0.5	(8.6)
(Increase)/Decrease in Accounts Receivable		(4.1)	(4.1)
Increase/(Decrease) in Accounts Payable		0.4	1.8
Cash Flow from Operations		43.2	29.3
Investing Section			
Capex Spend (Capital Expenditures)		(10.0)	(10.0)
Cash Flow from Operations and Investment		33.2	19.3
Financing Section			
Additional Equity Capital		13.0	7.0
Less Dividends Paid		(7.5)	(5.0)
Increase/(Decrease) in Long-Term Debt		-	-
Increase/(Decrease) in Short-Term Notes		1.5	(1.5)
Cash Flow from Operations, Investments, and Financing		40.2	19.8
Beginning Cash Balance		56.3	36.5
Ending Cash Balance		\$96.5	\$56.3

Note the depreciation amount that is added back on the statement of cash flows. Depreciation is a predetermined incremental reduction in the value of fixed assets, such as property, plant, and equipment, on the income statement to account for their deterioration over time. This provides organizations a tax benefit to offset the investment in fixed assets. However, while depreciation is calculated and expensed on the income statement as the cost of using an asset over its life, this cost is a noncash charge (i.e., no one is paid). Since depreciation reduces net income on the income statement but doesn't reduce actual cash levels, depreciation is added back on the statement of cash flows to determine the actual cash flow.

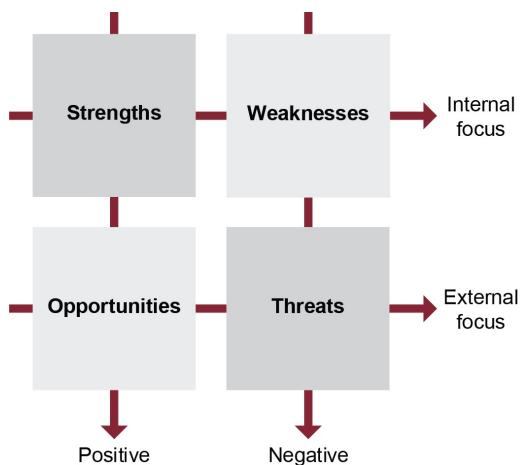
Topic 3: Strategic Analysis Tools

Among the tools that can be used for strategic analysis are the SWOT analysis, market research, network modeling and operations research, and the balanced scorecard.

SWOT analysis

SWOT stands for **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats. As seen in Exhibit 1-24, the SWOT analysis is usually in the form of a quadrant in which distinctions are made between internal versus external focus and positive versus negative points.

*Exhibit
1-24:
SWOT
Analysis*



How are each of these determined?

- **Internal strengths and weaknesses** are typically derived from comprehensive data collected about the organization. This may include information on skill sets by function, professional development and training activities, facilities, the company's reputation or standing in the community, etc. Ideally input from external customers and suppliers provides substantiated evidence, as to weaknesses in particular, that can then be appropriately addressed.
- **External opportunities and threats** are based on market trends and risk analyses. Environmental scanning may be required to assemble data on external forces. This involves collecting and analyzing external data on market forces; demographic changes; changing customer needs; competitor pricing and offerings; current and emerging technology; new taxes, laws, and regulations; and social, political, and economic conditions.

Opportunities can be acted upon to help move an organization toward achieving its goals. However, if those opportunities are ignored or improperly developed, they can transform into threats (like IBM giving Bill Gates the green light to market his disk operating system [DOS] because they weren't in the "software business"). Other opportunities may arise from competitors' activities or products or new markets or from other data seen during environmental scanning.

Threats are defined as risks that can impact a company negatively if they are not handled appropriately. External risks include unforeseen events outside the control of an organization that can diminish productivity, profits, or market share, for example, the 2011 Japanese earthquake and tsunami, which resulted in losses for many multinational companies around the globe. Of course there can be internal threats that arise due to a company's actions, such as overzealous geographic expansion or excessive outsourcing.

This valuable information feeds into a written document called the market plan.

Market research

In order to design a supply chain that can meet its ultimate goal of delivering the right product at the right place and time and at the right price, it's important to understand the marketplace.

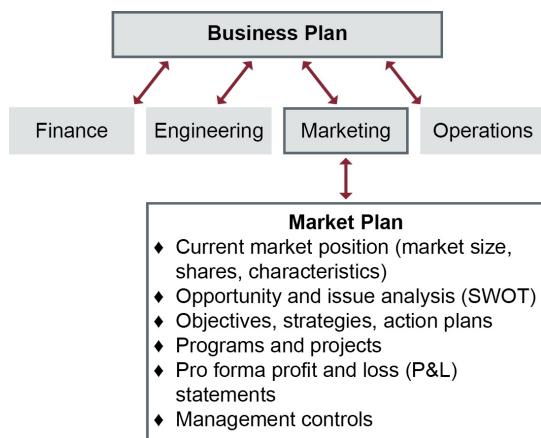
The strategic business plan drives several important functions like finance, engineering, marketing, and production. These functions also have input in shaping the overall business strategy. Here we're going to focus on the marketing function and how it provides foundational information about the marketplace.

Knowing your market, customers, competitors, and product can heavily influence how you design your supply chain to meet long-term objectives.

The marketing function develops its own strategically oriented plan based on the strategic business plan. Once again, these plans must be in alignment and there should be consistency between them.

As seen in Exhibit 1-25, the marketing strategy is based on a number of key elements.

*Exhibit 1-
25:
Marketing
Strategy
and Plan*



Research

Marketing begins its quest to understand the marketplace by doing **marketing research**. According to the *APICS Dictionary*, 16th edition, such research involves “the systematic gathering, recording, and analyzing of data about problems relating to the marketing of goods and services.” Also referred to as market research, it may be undertaken by impartial agencies, business firms, market research agents, or an internal marketing staff.

There are several types of marketing research:

- Market analysis: the study of the size, location, nature, and characteristics of markets (for example, product potential). More information on market segmentation is included in a later section.
- Sales analysis (or research): the systematic study and comparison of sales (or consumption) data and **market share** (“the actual portion of current market demand that a company or product achieves,” *APICS Dictionary*, 16th edition).
- Consumer research: the discovery and analysis of consumer attitudes, reactions, and preferences (including motivation research).

Market research can be conducted via a variety of information-gathering tools, such as customer surveys, interviews, focus groups, direct mail questionnaires, websites providing opportunities for visitor feedback, and market reports sold by research firms. Of course the internal marketing department staff can also do research about potential markets, products, etc. The SWOT analysis is commonly used for this purpose.

Market plan components

The **market plan** (shown in Exhibit 1-25 on the previous page) is defined in the *APICS Dictionary*, 16th edition, as including

the current market position, opportunity and issue analysis [SWOT results], marketing objectives and strategies, action plans, programs, projects, budgets, and pro forma profit and loss statement and management controls.

Current market position information may include data and findings about demand patterns, products and pricing, customer satisfaction, and service level agreements with partners, distributors, and retailers. (Note that a profit and loss statement is another name for an income statement. Pro forma means that the statement is based on forecasted information rather than historical information.)

When designing a supply chain, one must carefully consider the market plan. For example, if the market plan shows that Europe will be the primary source of demand for product X, it may make sense to assemble that product in the Netherlands instead of China, despite comparatively higher labor costs. By assembling a product in Europe, import duties may be much lower than for importing a finished product. (For example, Tesla assembles battery-powered cars in Tilburg.) The shipping volume of the parts may also be much smaller than the shipping volume of the finished products, so postponed assembly can save money in transportation costs.

In addition, one must keep in mind that marketplace factors may evolve over time, and, if they do, that may require modifications to the design of the supply chain and its organization.

Network modeling and operations research

Network modeling and operations research are tools that can be used to find the most efficient and effective or optimal strategic plan and network design for a supply chain. In fact, network modeling is frequently called network design. We will restrict this discussion to the subset of network design in which expert analysts create a mathematical model of the supply chain for supply chain managers.

A good model will represent the supply chain in all of its necessary complexity but be no more complex than

it needs to be (avoiding being needlessly complex and thus error-prone). It is a representation of a supply chain, not a supply chain itself, and so is complex enough when it can reliably help decision makers choose between available options.

Mathematical models have inputs, processes, and outputs. A model's input parameters can be adjusted to account for where facilities might be located, the number of these facilities, their function, their costs and related transportation costs, and so on. The model will have processes (mathematical relationships and formulas) that automatically translate the inputs into outputs. The outputs will indicate total network costs as well as any other key performance indicators related to strategy that the model developers include. These models are often developed in a spreadsheet such as Microsoft Excel, but more sophisticated modeling tools also exist. Modeling expertise is needed to develop, check, and validate such models. Model errors are easy to create, and there is a risk that the wrong decision will be made based on invalid outputs.

The *APICS Dictionary*, 16th edition, defines **operations research (OR)**, (called operational research in the U.K.), as

- 1) The development and application of quantitative techniques to the solution of problems. More specifically, theory and methodology in mathematics, statistics, and computing are adapted and applied to the identification, formulation, solution, validation, implementation, and control of decision-making problems.
- 2) An academic field of study concerned with the development and application of quantitative analysis to the solution of problems faced by management in public and private organizations.

Operations research is typically concerned with finding the minimum (e.g., minimum cost or risk) or the maximum (e.g., maximum profit, yield, or performance). Since the problems to solve are very complex, it is strongly tied to computer science.

The mathematical models developed with network modeling use operations research to solve for optimal network design. Network modeling and operations research are highly applicable to supply chain management because there are so many complexities to consider in an international supply chain. The benefit of harnessing these sciences is that decision makers have some assurance that the choices they are making in regard to expensive capital investments are likely to be wise in the long run.

Operations research uses a number of tools to find the best number and location of suppliers, manufacturing and assembly facilities, warehouses and distribution centers, and retail locations. The best solution depends on supply chain strategy. Some networks will minimize total supply chain cost while others will provide best value in terms of the most flexible, the highest quality, or the fastest flow of products through the network. Current best practices promote finding a solution that maximizes flexibility while minimizing cost so that the supply chain can both be resilient to frequent changes in the environment and provide the maximum potential for organizational profit.

Operations research relies on mathematical modeling, statistical analysis, simulation and optimization, economic methods, queuing theory, expert systems, decision analysis, and other tools. While it is beyond the scope of this text to describe these tools, let's look briefly at one common method: the Monte Carlo simulation. A Monte Carlo simulation randomizes each variable within its available range and runs thousands of simulations, and then it generates statistics to summarize the average results as well as other statistics such as the minimum and maximum. In this case, the optimum solution would be in the outliers of such a

model: the scenario that produces exceptional results.

Balanced scorecard (BSC)

Metrics provide a way to keep score, so it was only natural that someone would create a business-related scorecard. If your objective is to improve order fill rate from 93 percent to 98 percent, then you've created a contest with its own rules and an ultimate goal. Sure enough, in 1992 Robert S. Kaplan and David Norton introduced the balanced scorecard (BSC). Initially designed to give managers a comprehensive view of business performance, it has since been adapted to the design and measurement of supply chain performance.

You will be learning more details about the balanced scorecard and how it's used in a later section.

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