2022

2022 LEARNING SYSTEM
VERSION 5.0

MODULE 3

SOURCING PRODUCTS AND SERVICES

CSCP

CERTIFIED SUPPLY CHAIN PROFESSIONAL

APICS

ASCM ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT


2022
2022 LEARNING SYSTEM
VERSION 5.0
MODULE 3
SOURCING PRODUCTS AND SERVICES
CSCP
CERTIFIED SUPPLY CHAIN PROFESSIONAL
APICS
ASCM
ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT

APICS Certified Supply Chain Professional (CSCP) Learning System

This product is based on the APICS CSCP Exam Content Manual (ECM) developed by APICS. Although the text is based on the body of knowledge tested by the APICS CSCP exam, program developers do not have access to the exam questions. Therefore, reading the text does not guarantee a passing score.

The references in this manual have been selected solely on the basis of their educational value to the APICS CSCP certification program and on the content of the material. APICS does not endorse any services or other materials that may be offered or recommended by the authors or publishers of books and publications listed in this module.

Every effort has been made to ensure that all information is current and correct. However, laws and regulations are constantly changing. Therefore, this product is distributed with the understanding that the publisher and authors are not offering legal or professional services.

Acknowledgments

We would like to thank the following dedicated subject matter experts who shared their time, experience, and insights during the initial development and subsequent updates of the CSCP Learning System:

Greg P. Allgair
Celeste Ayers, CFPIM, CSCP
Curtis Brewer, CFPIM, CIRM, CSCP
Jashobrata Bose, CSCP
Al Bukey, CFPIM, CIRM, CSCP
Jesús Campos Cortés, CPIM, CIRM, CSCP, PLS, C.P.M., CPSM, PMP,PRINCE2, CQIA, CEI, CPF, CS&OP, CA-AM
Luc Chalmet, Ph.D, CFPIM, CSCP
Prashant Choudhary, CSCP
David N. Dadich, CSCP, LSS Blackbelt
Prasanta K. Dash, CSCP, PMP
Sudripto De, CSCP
Arnaud Deshais, CPIM, CIRM, CSCP, CPM, CPSM
Alan Downs, CPIM, CSCP
Ralph G. Fariello, CFPIM, CIRM, CSCP
Sue Franks, CPIM-F, CSCP-F, CLTD-F
Laura E. Gram, CSCP
Janice M. Gullo, CFPIM, CSCP
Amit Kumar Gupta, BE, CSCP
Debra Hansford, CFPIM, CIRM, CSCP, CPSM
Marwa Hassan Aburahma, MCIPS, CSCP, SCOR-P, CMILT
Joni Holeman, CFPIM, CIRM, CSCP
Eric P. Jack, Ph.D., CFPIM, CSCP
Rajesh Kumar Jagadeeswaran, CPIM, CSCP
Dave Jankowski, CFPIM, CSCP
Julie Jenson, CPIM, CSCP
Honey Johnson, CFPIM, CIRM, C.P.M., CSCP
Rajesh Kamat, CSCP
Prakash Kanagalekar, CPIM, CSCP
Jack Kerr, CPIM, CSCP, C.P.M.
Jose Lara
Paul S. Lim, CPA, CSCP, CPIM, PMP
Mike Loughman, CSCP
Giuseppe Lovecchio, CFPIM, CSCP
Thiagu Mathan, CSCP
Roberta McPhail, CPIM, CIRM, CSCP, PMP
Richard Merritt, CFPIM, CSCP, C.P.M.
Steven J. Miller, CSCP
Alan L. Milliken, CFPIM, CIRM, CSCP
Paulo Mondolfo, CPIM, CSCP
Peter W. Murray, CIRM
Eric-Stephan Neill, CSCP, CLTD, PMP
Mike Okrent, Ph.D., CIRM, CSCP
Roberto (Jake) Ordonez, CSCP, CQA, CTL, PLS, MPS, SCPro1
Kasthuri Rengan Ponnambalam, CSCP
Gautam Chand Pradhan, CPIM, CSCP
Ho Dong Rhee, CSCP
David Rivers, CFPIM, CIRM, CSCP
Maryanne Ross, CFPIM, CIRM, CSCP
Kimber Rueff, CPIM, CIRM, CSCP, C.P.M.
Frank Sabin, Ph.D., CSCP
Ignacio Sánchez-Chiappe
Carolyn Sly, CPIM, CSCP, C.P.M.
Liezl Smith, CPIM, CIRM, CSCP, ACPF, CDDP
Pam Somers, CPIM, CIRM, CSCP
Chad Stricklin
Shashank Tilak, CPIM, CSCP
Ken Titmuss, CFPIM, CSCP, SCOR-P, CPF, PLS, CS&OP, CDDP, CSCA, CDDL
Huan-Jau (Arthur) Tseng, CFPIM, CSCP
Dave Turbide, CFPIM, CIRM
Sudeep Valmiki, CSCP
Rob Van Stratum, CPIM, CIRM, CSCP
Rosemary Van Treeck, CPIM, CIRM, CSCP
Wout Verwoerd, CFPIM, CIRM, CSCP, SCOR-P
Robert Vokurka, Ph.D., CFPIM, CIRM, CSCP, C.P.M.
Eddie J. Whitfield, CPIM, CIRM, CSCP
Vivek Wikhe, CSCP
Blair Williams, Jonah, CFPIM, CSCP

Intellectual Property and Copyright Notice

APICS
8430 W. Bryn Mawr Ave., Suite 1000
Chicago, IL 60631

Module 3: Sourcing Products and Services

This module addresses the sourcing and procurement processes.

Sourcing involves strategic decisions, such as whether to make or to buy and, if buying, to determine sourcing requirements and timing. When considering suppliers, many large organizations now use a category management strategy to enable different categories of suppliers to get different amounts of sourcing attention. Such a strategy also enables conducting a supply base analysis to ensure that the number of suppliers in a given category is correct.

This module also addresses various ways to influence product designs, such as for manufacturability, sustainability, transportation, or warehousing.

The procurement process is a subset of the sourcing process, but it is more detailed and involves individual supplier decisions. Much of this process is operational in nature. Discussions include developing supplier selection criteria, negotiations, and contracting. The process of managing purchase orders and following up on exceptions is also covered.

Section A: Aligning Sourcing to Demand

This section is designed to

- Define a make-versus-buy analysis
- Describe the uses and factors involved in a make-versus-buy analysis
- Understand what constitutes a core competency and how it is relative to the competition
- Describe the reasons behind decisions to contract out portions of supply (e.g., outsource, offshore, and/or nearshore)
- Define sourcing requirements and timing
- Define the total cost of ownership
- Indicate how the total cost of ownership can be used to justify investments in the supply chain.

Starting with a goal of aligning the supply plan to the business strategy, supply chain managers determine the total cost of ownership of the supply network. Supply plans may lead to contracting out activities (e.g., outsourcing, offshoring). Part of this decision is determining whether to make or buy the necessary capabilities, components, or products. The results of these and other strategic supply choices are summarized in the supply plan.

Topic 1: Make-Versus-Buy, Outsourcing, and Offshoring

Sourcing involves strategic processes such as deciding whether to make or buy goods or services and setting category strategies to allow the vital few procured items to receive more attention than the trivial many. In addition, the procurement process involves selecting and working with suppliers.

After providing this overview of sourcing, here we delve into a strategic-level sourcing decision tool, a make-versus-buy analysis, and we also address contracting, including outsourcing and offshoring. Some organizations distinguish between make-versus-buy and outsourcing decisions to show that the process has evolved to become more strategic. This text treats the make-versus-buy analysis as a strategic decision that includes contracting for any activity, including products, subassemblies, business processes, or services. Offshoring is outsourcing to a different country.

Sourcing Road Map

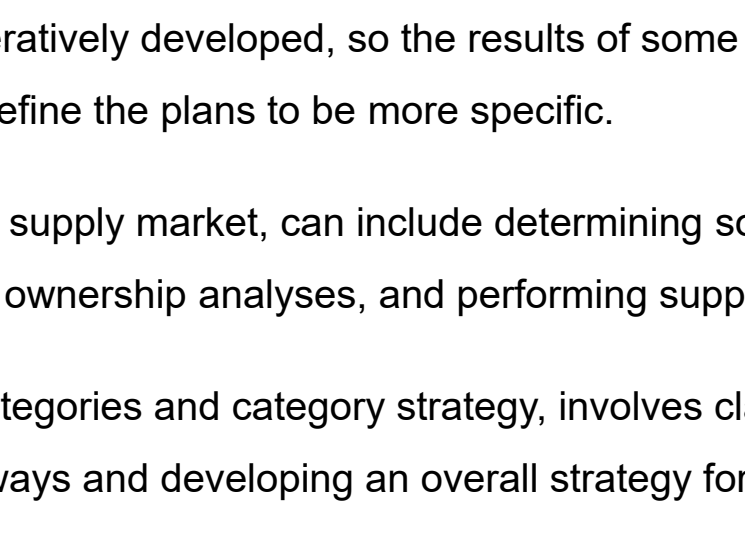
The advent of things like supplier relationship management (SRM) and strategic sourcing has had a strong effect on how organizations assess their sourcing alternatives, choose supply partners, and interact with their suppliers. Interactions are more collaborative, involving two-way discussions with suppliers on product design, material choices, and supply chain options and timing rather than just handing down specifications and deadlines. Technology has enabled this shift by streamlining many of the repetitive or time-consuming portions of sourcing processes.

The overall sourcing process is discussed next, followed by a discussion of the procurement process, which has strategic elements but is primarily tactical and operational. After that, there is a discussion of how to develop sourcing competency.

Sourcing Process

Exhibit 3-1 shows common steps in the sourcing process. Some of these steps might be taken in a different order, and some sourcing processes may have different steps.

Exhibit 3-1: Sourcing Process



The first step, develop and/or validate the supply plan, is a major strategic process in itself. Since most organizations already have supply plans, usually this is a process of revisiting the plans to address new product introductions, product retirements, new lines of business, and continuous improvement feedback. To stay focused, this step is often run using project management. A project team is determined, and a project charter is used to limit the scope of work to the organization's priorities in this area. Tools used can include make-versus-buy analysis, contracting or offshoring strategies, and consideration of existing systems (e.g., regional supply and manufacturing facilities, customer locations). Supply plans are iteratively developed, so the results of some of the later steps in the sourcing process are used to refine the plans to be more specific.

The second step, research the supply market, can include determining sourcing requirements and timing, performing total cost of ownership analyses, and performing supply market research.

The third step, create/refine categories and category strategy, involves classifying the organization's purchasing spend in relevant ways and developing an overall strategy for effectively managing purchasing categories. The fourth step, do spend and portfolio analyses, builds off of these organization-specific categories. A spend analysis can use tools such as a Pareto analysis to identify which categories have the most procurement spend and which suppliers get relatively more spend. This is useful for rationalizing or right-sizing the supply base. A portfolio analysis is an assessment of how much you need the suppliers in a given category. It places categories into groups related to their strategic importance versus supply chain difficulty (bottleneck, core competency, leverage, and commodity). The fifth step, segment suppliers, also complements the category strategy by determining

the proper level of relationship for specific suppliers, and this is based on the portfolio analysis and on how much the supplier needs the organization.

The sixth step, conduct procurement processes, is addressed more next. The seventh step, continuously improve, is a feedback step that involves determining how to improve the supply planning process or specifying areas of the supply plan or categories that need to be prioritized in the next version of the supply plan.

Procurement Process

Exhibit 3-2 shows various purchasing functions. Often a senior, experienced individual is responsible for the strategic tasks, and others will oversee the tactical tasks. As purchasing has become more strategic and global, purchasing roles have been stratified according to strategic and tactical expertise.

Exhibit 3-2: Functions of Purchasing

The individual with the strategic role may be charged with tasks such as

- Identifying and researching strategic partners
- Assembling and managing the sourcing risk portfolio
- Developing certification standards and supplier improvement programs
- Conducting make-versus-buy analyses
- For buy decisions, determining whether to outsource or offshore and what types of contracts to use
- Negotiating long-term contracts
- Adding value to products by managing supplier and strategic sourcing relationships
- Serving on cross-functional teams to integrate workflows and share data
- Enforcing compliance with sourcing contracts and related supplier policies
- Analyzing purchasing data to report impact on corporate goals and to identify areas for improvement.

The more tactical tasks, managed by one or more persons, may include

- Managing supply (planning and procuring supplies based on the master production schedule, auditing present needs on the manufacturing floor, releasing work orders, creating purchasing planning schedules)

- Issuing purchase orders
- Tracking orders
- Resolving discrepancies or exceptions in orders or accounts
- Monitoring the performance of suppliers and issuing reports on timeliness, completion, policy compliance, and quality of work.

Developing Sourcing Competency

Various sourcing technologies or services put in-depth information about the supply channel in the hands of purchasing managers, planners, and purchasing agents/buyers in real time. The requirements for purchasing jobs have changed accordingly. A survey of job postings shows that managers must have a greater understanding of the corporation's business goals (rather than merely the departmental goals) and how purchasing can affect the achievement of those goals. They must have substantial analytical abilities and people skills, including awareness of cultures with which they may come into contact. Global expertise (market research, knowledge of taxes and local laws) is necessary. And purchasers must be customer-centric.

Planners, purchasing agents, and buyers must be familiar with a host of sourcing and supplier relationship management technologies, but they must also be creative in translating corporate purchasing strategies into specific tactics and in finding opportunities to improve tactical processes. They must be detail-oriented and able to track global logistics and contract performance.

As the world's economy becomes increasingly integrated, it is imperative for purchasing management to master the best practices for operating successfully in a global market. Organizations need skilled operations management and supply chain management professionals to keep their business favorably positioned throughout their markets. The ideal manager for international suppliers will need a special set of soft skills. The individual should be someone who can moderate a discussion of expectations and who is sensitive to the values and needs of the other party's culture.

Make-Versus-Buy Analysis

The *APICS Dictionary,* 16th edition, defines **make-or-buy cost analysis** as follows:

> A comparison of all of the costs associated with making an item versus the cost of buying the item.

An associated definition from the *Dictionary* is for **make-or-buy decision :**

> The act of deciding whether to produce an item internally or buy it from an outside supplier. Factors to consider in the decision include costs, capacity availability, proprietary and/or specialized knowledge, quality considerations, skill requirements, volume, and timing.

Make-versus-buy is strategic, because global sourcing of processes or products is a complex and challenging decision that impacts organizational profits and reputation. Make-versus-buy is also tactical; when procuring and delivering goods and services, individual decisions can be made on an ongoing basis to address current prices, current capacity, and so on.

Before selecting a partner to provide materials or services, a supply chain company needs to ask and answer a set of questions about the possible consequences of giving the activity in question to another company, including

- Is the activity a core competency?
- What are the consequences of losing related skills or knowledge?
- What is the landed cost (or total cost of ownership)?

Is the Activity a Core Competency?

There is seldom a good reason for outsourcing a core competency; there are very good reasons to contract out tasks an enterprise does only adequately or poorly. A logistics specialist can make its clients look very good by providing customers with same-day or next-day service (plus other options). But if an enterprise has its own fleet and is known around the region for the color of the trucks, the skill of the drivers, and flawless delivery, it should carefully consider the effect on its image before letting a third-party provider take over its delivery functions—even if logistics isn't a core activity.

When considering contracting out components of a product or service, the core competency question revolves around whether the component is integral to the device or if it is modular. An integral component is typically unique to a product, and if it fails the whole product fails. A modular component is interchangeable with other variants on the market, such as a computer component. Integral components are much more risky to outsource.

A detailed process for considering core competencies in the make-or-buy decision is described in *Customer-Centered Supply Chain Management* (Kuglin, 1998). As an example, assume that an enterprise is considering contracting with a supply chain partner, yet to be identified, to provide its customers with overnight order-to-delivery service. Kuglin's process might be adapted as follows.

- **Step 1: Determine whether the enterprise already has overnight order-to-delivery as a core competency.** In making this determination, the enterprise consults both internal and external experts among its clients and providers. If there is a difference of opinion, the enterprise does further research to decide which opinion is correct. It is possible that the enterprise believes overnight delivery is a core competency while clients say otherwise. It is also possible that clients believe the enterprise has overnight delivery as a core competency but the enterprise itself is not fully aware that it has that capability.

(Kuglin uses the process as part of a complete transformation to a customer-centered supply chain leader. In that effort, the enterprise develops a complete list of all core and non-core competencies as part of a decision of what activities to contract out and which to keep or develop as core competencies.)

- **Step 2: Determine whether there is a need in the marketplace for overnight order-to-delivery service.** While interviewing customers and suppliers about the core competency of the enterprise, the interviewers also question respondents about the need for the capability in the marketplace.

- **Step 3: Determine the relationship between the enterprise's capability to deliver the service and the need for the service in the marketplace.** The preceding steps can produce several outcomes:
  - The marketplace needs overnight delivery and the enterprise already can meet that need as a core competency. In this case, the enterprise might choose to market its capability to raise awareness in the marketplace. (It will "make" rather than "buy" overnight delivery.)
  - The marketplace does not need overnight delivery, in which case the enterprise may not need to maintain, develop, or buy that capability.
  - The marketplace needs overnight delivery, but the enterprise is not able to provide it as a core competency. This situation triggers the final step, which is the make-or-buy decision either to develop the capability or to find a supply chain partner who can do so as a core competency.

- **Step 4: If a need for overnight order-to-delivery service exists in the marketplace and that capability is not a core competency of the enterprise, determine whether to develop the capability as a core competency or to contract with a supply chain partner.**

  - *Develop the core competency to perform the activity.* The company may decide to develop a core competency in providing overnight order-to-delivery service. This may be advisable if doing so is consistent with the company's mission and vision—and if the company has the resources to develop the core competency within a time frame acceptable to the market.

  - *Contract out the activity.* Having decided to outsource overnight order-to-delivery service, the enterprise makes a short list of available third-party logistics providers and selects one to develop into a supply chain partner. The selection process may be accomplished by soliciting proposals. However, Kuglin suggests instead developing a business problem and asking potential providers to work with the enterprise to find a solution. This method tests the unique abilities of each company.

What Are the Consequences of Lost Skills or Knowledge?

When an enterprise contracts out functions to another company, domestic or foreign, it may be divesting itself of valuable expertise. When all the components of a complex electronic system are made offshore, for example, the enterprise no longer maintains the knowledge of those systems in-

house. The skill, knowledge, and perhaps the creativity of its former workers in that area are gone and cannot be easily recovered. The costs of those losses may be difficult to measure and balance against the gains, but they are real.

The result of a nuanced analysis may be that an activity is only partially outsourced. For example, Toyota

- Allows the electronic systems in its vehicles to be both designed and produced by external suppliers
- Retains the design portion of its vehicle transmissions but outsources much of transmission production
- Both designs and manufactures all of its engines because this is a core competency.

What Is the Landed Cost (or Total Cost of Ownership)?

Once an enterprise has decided to contract out a particular component or service, attention turns to comparisons of quality, cost, and availability. The traditional cost measurement in this case is landed cost, which is the cost of the item including all costs to deliver it to the organization (transportation, tariffs, etc.). If the goods from domestic and foreign sources are of equal quality and cost becomes a main consideration, landed cost provides a better basis for a meaningful comparison than just price. In other cases, such as when quality differences require broader analysis, total cost of ownership may be used to compare costs in a make-or-buy decision. Total cost of ownership starts with landed cost but considers many more factors, such as quality costs and life cycle costs.

Components or services delivered by a foreign supplier are often priced far lower than those produced domestically. Even assuming that the components or services are of the same quality, however, there are other considerations. Will foreign suppliers be able to provide the components in sufficient quantities to meet production needs? Will the (likely) longer lead times and larger delivery sizes (higher average inventory) be acceptable? Are there infrastructure constraints that may stall shipments unexpectedly? Will labor, economic, or political problems suddenly cut off supplies? Will shipments be secure against pilferage, damage in transit or handling, tampering, and terrorism? Finally, what other costs are incurred by bringing the components to the manufacturing site from a foreign rather than domestic producer, such as higher monitoring and control costs?

Making the Decision

Organizations justify their make-or-buy decision by comparing the advantages to the risks and costs of each alternative. As was implied in the previous discussion of Kuglin’s step-by-step process, a primary aspect of this decision is whether an outsourcing partner can provide the organization with new capabilities because they have complementary core competencies. The organization weighs these potential advantages against the drawbacks of contracting such as potential loss of skills and knowledge and higher-than-expected landed costs. Sometimes the result is that the organization settles on a hybrid approach, retaining some processes and outsourcing others.

Contracting and Outsourcing

Contracting out activities to third parties can take many forms, including outsourcing and offshoring or the use of service providers such as third- and fourth-party logistics providers.

Outsourcing is a popular term, but it isn't always the correct one. For example, if the organization never did an activity in the first place and then finds a third party to provide that capability, it isn't really outsourcing it but is instead contracting for those services. However, "outsourcing" is commonly used interchangeably with "contracting out," so this topic treats it as a synonym. The *APICS Dictionary,* 16th edition, defines **outsourcing** as

> the process of having suppliers provide goods and services that were previously provided internally. Outsourcing involves substitution—the replacement of internal capacity and production by that of the supplier.

Outsourcing can be contrasted with **insourcing** , which the *Dictionary* defines as "using the firm's internal resources to provide goods and services." A synonym for outsourcing is **subcontracting**, which involves "sending production work outside to another manufacturer."

Trends in Contracting

Anything that can be digitized can be contracted out globally. As a consequence, many corporations have sought out the cheapest labor sources in a wide variety of occupations. This outsourcing takes place in many directions—not only from developed countries to emerging economies. Developed countries now outsource to one another. Japanese car companies once made inroads into U.S. and European markets with low-priced automobiles. When the competition responded and transportation costs increased, the Japanese car companies began moving production closer to customers in countries such as the U.S. and Canada. Similarly, American car companies are now successfully manufacturing American cars in China for sale to Chinese consumers.

Another trend in contracting is the use of smart contracts. Smart contracts use blockchain technology (a distributed ledger that forms a chain of permanent records one secure "chain link" at a time) to make contracts more legally defensible because the record, once agreed to by all parties, is almost impossible to surreptitiously alter. The contracting process can also be conducted remotely and quickly. However, a smart contract can be amended fairly easily by adding another link in the chain to the blockchain ledger, following agreement by all parties.

Examples of Supply Chain Contracting

Many of the Fortune 1000 companies contract out multiple business processes, from payroll to manufacturing. The following are some outsourcing examples related to supply chain management.

- **Supplier relationship management (SRM).** SRM organizations with experience in a particular region could assume responsibility for transactional purchasing or supplier sourcing, contract

negotiation, two-way communications of expectations, and compliance management. Outsourced SRM can also provide strategic support for alliances such as spend analysis or facilitating design collaboration.

- **Manufacturing.** Manufacturing can be contracted out to organizations that have advantages in labor costs, are located closer to raw materials, or have special expertise in producing products or subassemblies efficiently at expected quality levels.

- **Logistics and logistics management.** Third- and fourth-party logistics providers are ways of contracting out logistics operations or its management.

- **Customer relationship management (CRM).** CRM suppliers may provide call centers or advanced telephony services (like universal queue or voice recognition), database collection and management, and online service agents. The best CRM suppliers train their service representatives in their clients' products and processes to make performance seamless.

- **Information systems.** Offshore development of custom technology applications can reduce labor costs significantly. Software as a service (SaaS) can be seen as a way to limit investment in software, hardware, and support staff for systems that otherwise become obsolete quickly.

Benefits of Contracting

Potential benefits of contracting out activities include the following:

- **Economies of scale.** A third-party provider with a core competency in the activity may have numerous customers for the given activity and therefore can spread its fixed costs over more units of the good or service.

- **Risk reduction.** Contracting transfers risks, such as demand uncertainty, to the third-party provider. The provider may be better equipped to manage demand uncertainty by spreading forecasts over a larger number of customers. (It may handle many more orders than those brought in by any one of its clients, which reduces risks through risk pooling.) The outsourcing provider may also be able to react more rapidly to changes in customer demand.

- **Increased capital available for investment.** Since some of the capital required to engage in the outsourced activity is supplied by the third-party provider, the enterprise has more capital available for research, payment of dividends, debt reduction, etc.

- **Clearer focus.** An organization contracts out an activity only if it is not a core competency (in most cases). This increases the organization's ability to focus on core competencies.

- **Access to new technologies.** The third-party provider, because it focuses on the outsourced activity as a core competency, is more likely to have the latest and most effective resources for carrying out

that activity. Indeed, if it is to maintain its market share, it must keep up with advances in strategy and technology.

- **Access to regional benefits or avoidance of regional issues.** A third party may operate in a market that is currently underserved and so can provide better market access. The third party also may be able to help the organization avoid certain regional issues, such as requirements for majority local ownership.

- **Faster development cycle times.** The third-party supplier's technical expertise may enable the enterprise to accelerate development time for new products or services.

Complexities of Contracting

Contracting reduces some complexities, since the organization will no longer need to perform or directly administer certain tasks. At the same time, it increases the complexity of other forms of business administration, especially for monitoring and controlling and risk management. Risks include poor quality, intellectual property theft, supplier corruption/fraud, or failure to maintain organizational policy such as for worker protection or environmental sustainability. These all relate to a higher risk of reputation damage, so organizations need well-developed contract clauses, legal review, audit functions to verify compliance, and enforcement mechanisms.

Offshoring

Outsourcing partners may be located near at hand or offshore. **Offshoring** is defined as "outsourcing a business function to another company in a different country than the original company's country" (*APICS Dictionary,* 16th edition). An organization could also offshore without outsourcing by opening a branch in a different country and hiring employees there to staff a business function. Thus, offshoring usually implies locating a business unit or facility in a different country, which could be directly owned or owned by a supply chain partner. Note that in many smaller countries that have numerous neighbors, offshoring could still involve relatively short distances. A related term, nearshoring, refers to this type of offshoring to a nearby country, often as a shift of business away from a more distant country.

Reasons for Offshoring

With offshoring, the first consideration should be organizational needs, not a search for "today's global sourcing hot spots." Only when an organization has thoroughly assessed its needs for offshoring is there a sound basis for evaluating and selecting specific countries and suppliers. An organization is then ready to consider how potential global suppliers can support the organizational value proposition.

Although cost cutting may be the primary driver for offshoring, it should not be the sole criterion. Another reason for global sourcing is market growth. Sourcing from a particular country may open up new market possibilities. Sourcing relationships allow an organization to learn about conducting

business in a potential market. Offshoring may also provide additional sourcing options. Sourcing or procuring products or services from more than one country develops alternate sources and can provide backup for emergencies or other supply chain disruptions.

Offshoring Complexity

Offshoring increases the complexity of assessing potential suppliers. Once a supplier is selected, offshoring increases the complexity of developing suppliers to continually improve products and processes. Dealing with foreign-based organizations requires understanding and overcoming complexities such as language differences, culture differences, country-specific processes, and legal, tax, and regulatory differences.

Many suppliers located in countries with lower labor costs also have less mature organizational levels, less emphasis on total quality initiatives, or less developed information visibility and technology. Investing in improving these factors adds to the total cost of ownership and may not provide a payback if the relationship must be terminated prematurely.

In addition, some countries with lower labor costs have onerous government regulations and bureaucracy that slow cycle times or permitting unless local expertise in navigating these impediments is obtained. Even with local expertise, organizations could be prohibited by their home country and/or organizational governance policy from engaging in certain locally expected activities (e.g., bribery).

Risk Management in Offshoring

Although many benefits may be achieved by offshoring, organizations must be careful about the risks they assume. Risks include failure to perform or deliver on time, failure of technology systems or electrical grids for unacceptable periods, or theft of intellectual property. Either the supplier or any transportation intermediary could be at fault, or the cause could be from “force majeure,” such as a natural disaster. Organizations need to exercise great caution in whom they work with and how much to trust these organizations, and they may need contingency plans such as backup suppliers to enable supply chain resilience.

One method of mitigating risks when embarking on offshoring is to build sufficient inventory prior to a move to prevent supply interruptions. For example, in the medical device industry, when a product line is offshored, it is not unusual for the organization to build one year of stock to mitigate the risks in the offshore transfer of the production line as well as regulatory risks. However, this is not an option if inventory faces fast obsolescence/perishability. Note also that there is a cost associated with such a build-up and this cost would need to be factored into the original analysis.

Another issue is how the organization will enforce compliance with its business goals and values. For example, many countries have relatively few government regulations related to environmental protection or sustainability. While avoiding onerous regulations could be among the reasons to choose

an offshore site, global organizations risk damage to their reputations if problems occur. Take, for example, the lead found in many children's toys and the contaminated foods that have harmed some organizations' reputations and bottom line. Compliance and control costs can increase significantly when using outsourcing or offshoring.

The key point related to risk in any outsourcing arrangement is that the organization remains the responsible party in the eyes of the customer, so it must seek ways to manage its exposure—perhaps through pilot programs, close monitoring for compliance, maintaining backup suppliers, or redundant capacity.

Comparing Manufacturing and/or Assembly Sites

Sometimes organizations contract out manufacturing but continue to perform assembly of the final components, while other organizations choose to outsource both of these activities. Final assembly in the country of sale may lessen tariffs, reduce transport costs for bulky items, and enhance the organization's reputation by providing local jobs. Determining the relative costs of manufacturing and/or assembly in different markets is as complex as comparing landed costs for goods.

Exhibit 3-3 summarizes some of the advantages and risks of product manufacturing and/or assembly in another country.

Exhibit 3-3: Advantages and Risks of Overseas Manufacturing and/or Assembly

Advantages	Risks

Advantages	Risks
• Low labor rates (depending on country) • Lower material costs • Lower benefits costs in countries with national health care • Favorable duty rates (especially if materials are domestic) • Lower taxes • Smaller capital investment (if assets are transferred to foreign country) • Ability to be agile as customer requirements change • Foreign country experience and market opportunity	• Possible costs and disruptions caused by time zone differences (as much as 15 hours between United States and Asia) • Higher transport costs and longer lead times • Higher relationship management costs for communications, travel, monitoring, etc. • Possible political risks in unstable, unfriendly countries • Costs of hedging currency exchange risks • Costs of maintaining environmentally responsible forward and reverse logistics chains • Environmental costs for mitigating air, water, and noise pollution and preventing spread of invasive species • Higher costs of increased safety stock • Costs of holding inventory in warehouses or in the pipeline • Shrinking inventory due to theft, damage, spoilage, etc. • Increased costs of insurance against damage, theft, spoilage

Source: APICS, Advanced Supply Chain Management

Topic 2: Sourcing Requirements and Total Costs

Sourcing requirements, including delivery timing requirements, can differ widely among different types of products and services, so it is important to arrive at these decisions as soon as the decision has been made to contract out the good or service. A more detailed total cost analysis may also be needed once potential sources are being considered and more costs can be known.

Sourcing Requirements and Timing

Once the organization has recognized the need for selecting one or more new suppliers through processes such as a make-versus-buy analysis, the next step is to determine sourcing requirements, including the necessary timing. Sourcing and timing requirements are not homogeneous. Determining sourcing and timing requirements and priorities often requires a detailed analysis. Evaluations should result in decisions for each category of requirement. Categories may include

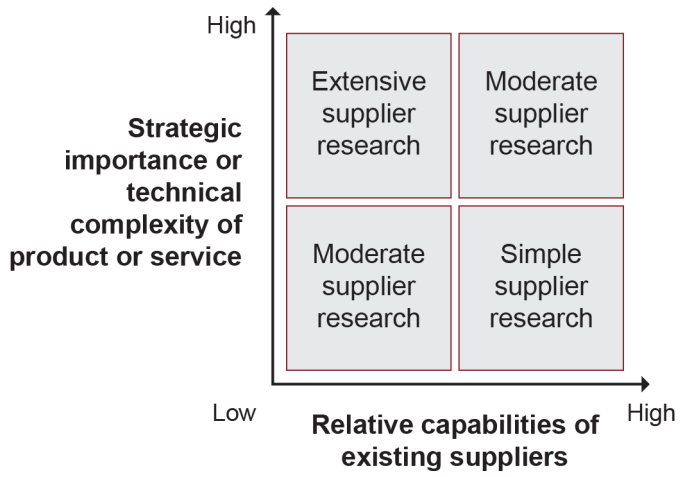
- Cost to organization and target price to consumer
- Quality culture and product/service quality

- Delivery performance (due date promises and scheduling, delivery window size, acceptability of early or late deliveries, how to measure, and penalties for failures)
- Lead time (slow and cheap to fast and expensive)
- Available capacity (and ability to change capacity)
- Design expertise or ability to collaborate
- Time to market (in weeks or months, plus ability to improve this duration)
- Sustainability.

For example, a clothing staple item may have requirements for quality that ensure that the item is durable enough but also low enough in cost to enable low prices. Delivery performance may need to be average. Lead times can be long. The supplier may need to provide high capacity for large bulk orders but may not need to collaborate much except for providing cost-cutting suggestions. Time to market may be a low priority unless there are pending shortages. Sustainability depends on the organization's values. The top priority is low enough cost to maintain an acceptable profit margin.

Once a set of sourcing requirements is determined, a sourcing search can begin. The intensity of this search depends on the strategic importance or technical complexity of these sourcing requirements plus the relative capabilities of existing suppliers, according to Monczka, et al., in *Purchasing and Supply Chain Management.* Exhibit 3-4 shows this relationship.

Exhibit 3-4: Research Relates to Requirements and Existing Supplier Capabilities



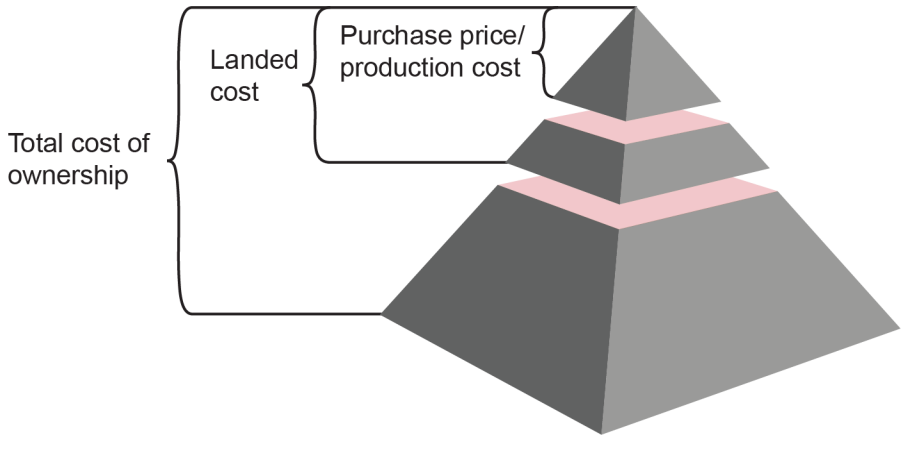
Total Cost of Ownership (TCO)

According to the *APICS Dictionary,* 16th edition, the **total cost of ownership (TCO)** is defined as follows:

> In supply chain management,...the sum of all the costs associated with every activity of the supply stream.

Two other inventory-related cost category terms are purchase price/production cost and landed cost. Exhibit 3-5 shows how these terms relate to one another.

Exhibit 3-5: Relationship between Cost Terminology



The purchase price or acquisition cost is the price per unit of materials acquired from suppliers. Production cost is the cost per unit of direct materials, direct labor, and factory overhead (cost of goods sold) that is applied to products produced by the organization. According to the *Dictionary,* **landed cost** "includes the product cost plus the costs of logistics, such as warehousing, transportation, and handling fees."

The total cost of ownership includes all of the above costs, plus it considers all other lifetime ownership costs such as durability, ongoing maintenance costs, and responsible disposal.

Use of TCO

The intent of TCO is to get decision makers in the supply chain to see supply chain activities as an investment in capabilities rather than just an expense to be minimized. TCO is primarily a strategic rather than tactical measurement tool, meaning that it is used to select between supply chain strategy options. Once a strategy has been selected, TCO can be used for performance measurement to assess how well the strategy is contributing to organizational strategy and as a high-level control over the end-to-end supply chain process. TCO may change over time and should be periodically reassessed. For example, labor costs in developing countries may increase over time relative to other countries and the lowest cost solution may change accordingly.

TCO compares the differences between incremental (or marginal) costs of alternative supply chain solutions. An incremental cost is the cost associated with producing one additional unit of a product or service. Some costs remain relatively stable until they go above or below a certain level of capacity, at which point they step up or down in incremental cost. Measuring incremental costs considers the effects of system constraints on proposed solutions.

Determining What Costs to Include in Analysis

A supply chain is a complex system with multiple costs. Effective analysis requires selecting only those costs that help differentiate between alternative strategies. Costs that are the same for each option are omitted from consideration. Being consistent in the choice of costs to include allows comparison of multiperiod measurements or competing alternatives.

TCO considers both tangible and intangible costs. Tangible costs can be given a value using objective measures such as market value; intangible costs are difficult to measure in financial terms yet may have a real impact, especially in the long term. Examples of intangible costs include customer satisfaction, employee morale, quality, risks (e.g., outsourcing partner failure to meet obligations), or loss of intellectual capital. Such costs may be estimated and included in TCO, but the estimates should be conservative or based on a formula so they are less likely to be rejected by decision makers.

Dividing costs into landed costs, process change costs, and ongoing costs can help determine what costs to include in an analysis and what costs to omit because they are not relevant or would only complicate the analysis.

Landed Costs

Landed costs are often the most important costs considered for a TCO study of the supply chain. Some important landed costs that frequently differ between alternatives are

- Purchase price/production cost
- Transportation cost (at each stage), including special packaging costs
- Customs and related costs (tariffs, duties, taxes, fees for various intermediary services)
- Inventory costs (carrying, ordering, and backorder costs)
- Outsourcing cost
- Monitoring and control costs, which are generally higher when outsourcing is used (e.g., sending employees abroad to manage the relationships).

Some landed costs may or may not differ between the alternatives or may be omitted from consideration to simplify analysis. Such costs could include

- Financing and opportunity costs
- Sales and marketing
- Administrative (executive, clerical, including billing/payment, and information system)
- Reverse supply chain (returns)
- Insurance and risk management
- Taxes and foreign exchange (relevant for global sourcing decisions).

Process Change Costs

Process change costs include the costs of evaluating choices and implementing the changes to the supply chain. These costs are sometimes called pre-transaction costs because they are administrative costs often incurred before landed (transaction) costs are incurred. Such costs may include

- Requirements identification and research
- Product development
- Contract sourcing (search, selection, qualification, and legal review)
- Process change and training of supplier and organization in each other’s operations

- Plant openings/closings, hiring/layoffs
- Supplier education and integration (including software systems integration).

Ongoing Costs

Ongoing costs (or post-transaction costs) are the costs of ownership that occur throughout the life of the product or equipment. A durable product will have lower ongoing costs than one that costs less but has lower quality. Examples include

- Life cycle costs (quality, durability, and maintainability versus price)
- Maintenance, repair, and operations and other ongoing service and repair part costs
- Costs of quality (line fallout, defects, in-house or field repairs, rework, returns, warranties)
- Sustainability costs (recycling, recovery of materials, etc.)
- Reputation costs (customer loyalty versus lost customers).

Net Costs

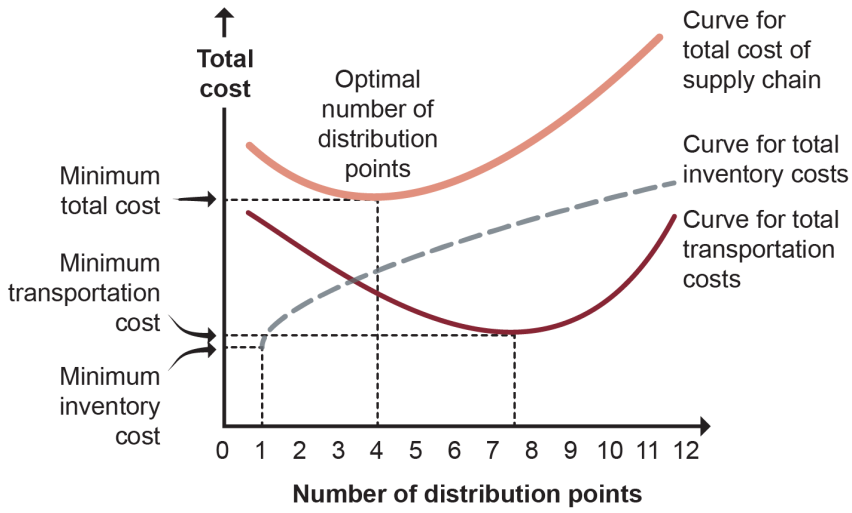
TCO measures the net effect of all cost increases and cost reductions.

Research by Kalakota and Robinson on TCO related to offshore outsourcing reported a reduction in total labor costs of 70 percent, an increase in total transportation costs of 20 percent, and an increase in the organization’s monitoring and control costs of 20 percent, for a net reduction in costs of 30 percent. TCO analysis can thus sometimes help make the case for closer sourcing.

Research by Lewis, Culliton, and Steele compared two alternatives for sending electronic parts directly to customers. The first option was to centralize inventory in a single warehouse and make all shipments using rapid air transport services. The second option was to have regional warehouses combined with cheaper transportation options. The first option was found to have the lowest total cost because the higher cost of transportation was offset by the lower total costs for inventory and warehousing. Part of the reason for this is that electrical parts are small and inexpensive to ship via air. Other items and supply chains will have different relative costs.

shows how a TCO economic tradeoff study can show that the lowest total cost for a supply chain is often at a different point than the lowest total cost for any given system component. The exhibit compares the number of distribution points to total costs. Note that a single distribution point would produce the lowest inventory cost, while seven or eight distribution points would minimize total transportation cost. Four distribution points result in the lowest TCO. Note also that this is just the TCO for distribution. A separate analysis would be needed for supply-side and manufacturing costs.

Exhibit 3-6: Determining Economic Tradeoffs in Total Cost of Ownership for Distribution



TCO Challenges

A key observation to make from is that total cost analyses grow more and more complex as more costs are considered. The above analysis takes no consideration of transportation lot sizes, the global distances involved, or the amount of safety stock to maintain in the system, to name only a few factors in the total cost of a supply network. Therefore, TCO analysis may require sophisticated analytical tools such as a network model for scenario or simulation use or a decision support system. Either tool can optimize multiple factors such as actual locations of facilities and actual transportation options to generate a globally optimized supply plan.

One way TCO integration can be accomplished is if TCO is incorporated into control and continuous improvement tools such as a scorecard or dashboard. These tools can also ensure that customer service or other objectives are given weight in the analysis. When properly implemented, TCO can help organizations and supply chain partners make and justify wise, cost-effective choices for the long term.

TCO can be difficult to implement at an organization, much less across a supply chain. Organizations have long-standing department-specific cost reduction policies, management incentives, and accounting practices in place that may penalize individuals for failing to minimize costs in their departments. A TCO strategy therefore requires extensive process changes starting at the executive level, realignment of management incentives toward total cost, and a method of measuring and rewarding success based on achieving least total cost. These change issues are magnified in an extended supply chain.

Should-Cost Estimate

When estimating the total cost of ownership in an extended supply chain, one complication is that actual or potential suppliers may not share their cost information. One way to compensate for this is to use a should-cost estimate.

A should-cost estimate is an estimate of the cost drivers for a given product or service that leads to an estimate of how much it should cost to produce a good or service in a given region and get it to a

desired location. This estimate is sometimes used along with a target pricing process, which determines the price the market will bear.

A cost driver is an element that strongly contributes to how much something costs. Cost driver categories may include materials, labor, overhead, transportation, materials management, quality, inventory carrying costs, and administrative costs. Each of these categories can have several cost drivers. For example, materials cost drivers could include market prices for commodities, engineering tolerances, design limitations, manufacturing lead times, and manufacturing process choices. Labor may include degree of skill, safety issues, scrap levels, learning curves, and so on. Overhead could include the complexity and expense of machining and tools, maintenance costs, and production space requirements.

Supply market scanning in a specific country or region can provide information on typical cost driver rates and quantities. Government data or data from industry standards may also be used. The analysis team should include a set of experts with local area knowledge and knowledge of the production processes involved.

The results of a should-cost analysis can then be compared to supplier responses to requests for quotations or to internal costs. This can provide the organization with negotiating leverage or a best alternative to a negotiated agreement with a supplier (such as to make it oneself if that cost should be lower than what the supplier is indicating).

Section B: Category Strategy for Sourcing

This section is designed to

- Align and optimize supply plans
- Determine supply categories and a category strategy in part by assessing the strategic importance or complexity of the materials as well as their availability
- Perform a portfolio analysis to group categories into commodity, bottleneck, leverage, and core competency materials
- Use a segmented sourcing strategy by determining how much you need each supplier and how much each supplier needs you, and then classify each supplier as transactional, preferred, strategic, or owned
- Identify the range of buyer-supplier relationships
- Discuss how each type of buyer-supplier relationship has its uses in a supply chain
- Describe how a supply base analysis can help in determining, validating, and winning approval for the supply plan
- Use spend analysis to identify which suppliers got more spend than others and which categories could benefit from a right-sizing of the number of suppliers.

Supply plans need to align with the organization's overall strategy, but different types of materials need different types of management to ensure both effective use of the materials and efficient use of operations and management resources. A common way to add nuance to supply plans is to create categories of things that need to be purchased, determine the relative importance of the category to the organization, and then decide upon the appropriate type of relationship to have with each supplier. Using a segmented sourcing strategy helps determine this relationship type.

Topic 1: Supply Plans, Categories, and Segmentation

Supply plans need to be developed related to sourcing strategy. Category strategies help provide nuance to these plans. Supplier segmentation differentiates the level of integration with suppliers.

Supply Planning

Developing a supply plan is the strategic design of a supply network based on total cost of ownership, make-versus-buy decisions, sourcing requirements, and desired or necessary levels of buyer-supplier relationships. Supply plans set the organization's design for how it will identify and manage suppliers.

Supply plans answer questions such as

- Are we going to have centralized global sourcing, will each location source independently, or will there be a combination of these methods?

- Will we seek local sources over cheapest sources?
- What are our contingency plans for supply risks?
- Will we need to rely on sole-source suppliers or decide to use single-source suppliers?
- What are the differences in our supply plans for strategic versus nonstrategic material sourcing?

The last two items in the supply plans are often addressed using a category strategy.

Plan Validation and Refinement

The results of the prior analyses may need to be validated and refined at a high level to take into account additional considerations such as the following:

- **Corporate strategy alignment.** The supply planning process starts with corporate strategy as an input, so the proposed supply plan should be built from the perspective of meeting corporate goals for customer service, production capacity, and product quality. Any differences must be resolved at this point, either by providing decision makers with several supply plan options if all of these factors cannot be simultaneously met or by making a case to change corporate strategy if analysis shows that the desired service, capacity, and quality are not feasible or profitable.

- **Corporate mission and culture alignment.** Developing supply plans takes the results of the analyses discussed in these materials and determines if the results suggested by computer optimization integrate well with the organization’s mission and culture. For example, a corporate social responsibility policy regarding supporting local communities may override a global sourcing decision if the cost difference is considered acceptable given the social and reputation benefits received.

- **Risk assessment.** The risks of a supply plan must be spelled out for decision makers at a high level, including an assessment of the likelihood of each identified risk, its impact if it occurs, and possible means and costs involved in mitigating risks. Process change risks should be called out. Contingency plans should be included.

- **Centralized versus autonomous sourcing.** Centralized control over sourcing decisions to generate the systemic savings may need to be balanced against some amount of autonomy for local sourcing. While centralized sourcing provides the benefit of control, autonomous sourcing provides local expertise and the ability to personalize supplier relationships. However, local management can have a local bias. Centralized control for strategic sourcing with some autonomy for nonstrategic sourcing may generate a good balance if the local areas are guided by central policy and controls.

- **Additional optimization.** Given high-level tentative approval of the supply plan, some additional strategic refinements can be made to increase customer service, capacity, or quality or reduce costs further without significantly changing the plan. For example, when distribution locations have overlapping territories, the supply plan can specify which of these locations will provide the fastest or

least costly delivery to a given area, and that distribution point can be designated as the primary distributor.

- **Planning for future growth.** A supply plan is a long-term plan, so it must incorporate the flexibility to grow to meet continuous improvement goals, additional demand, and/or new products and services. A benefit-cost analysis for each alternative supply plan should consider the plan over a base period plus the costs involved in growing these capabilities over an extended forecast horizon.

One way to measure a plan's flexibility is to measure the baseline level of customer service, output capacity, and quality in the optimized supply chain and then calculate the incremental costs of increasing each factor. A mathematical analysis called a sensitivity analysis can help make this determination. For example, if the supply plan is capable of fulfilling 96 percent of customer orders within 72 hours but long-term strategy calls for increasing these amounts to 98 percent of customer orders or filling them within 48 hours, the costs to make these changes can be quantified by their incremental increase.

These tests could result in plan changes or in contingency plans. For example, a supply plan could include different contingency plans for increasing customer service without significantly changing the supply plan strategy:

- Increase customer service by increasing planned safety stock levels. This strategy increases inventory costs but is a flexible solution.
- Increase customer service by adding more warehouses, which has a high fixed cost and reduces system flexibility.

Plan Finalization

Plan finalization involves executives (and possibly a broader range of stakeholders) weighing all factors —such as plan flexibility and ability to accommodate growth, the tradeoff between service levels and total system costs, and alignment with corporate mission and culture—and then selecting a final plan from among the competing options. Supply chain managers should develop and present a small number of supply plan options. The plans should be limited to those that can be sufficiently differentiated based on how their priorities are set. The supply chain manager can present the rationale for each option and then make a recommendation. The key is to make the argument in terms that the audience will understand, avoiding excessive details in favor of graphs or other visual tools to make the key points clear.

Once the supply plan is approved by all decision makers, it is just the beginning of plan refinement. After that, the organization researches the supply market as needed. Then, the organization may need to create or refine sourcing categories as well as the category strategy.

Category Strategy and Portfolio Analysis

Part of the sourcing process involves determining procurement categories and setting a category strategy. A spend analysis per category may also be conducted at this point.

Categories and Category Strategy

A category in terms of sourcing is a grouping of purchased goods or services and the suppliers that provide them. Categories are organization-specific. Categories should be made that the organization finds relevant to the management of suppliers and overall purchasing spend. A category is like a product family used for grouping the organization's saleable goods and services in that managing purchasing as a category helps add customer value. In this case, it is groupings of goods and services that need to be procured for use in operations, the supply chain, or business administration. Category strategies add nuance to supply planning by both helping to differentiate the types of things the organization needs and helping to segment types of suppliers into their optimum relationship levels. Specific category managers may be responsible and accountable for specific categories and their subcategories.

For example, an organization that makes college textbooks may have the following categories of outsourced activities or purchases: advertising; contract labor (research, writing, graphics design, and editing subcategories); printing; bookbinding; paper/cardboard; ink/toner; maintenance, repair, and operating supplies; logistics; IT; and so on.

The categories themselves are also classified in several ways, including by total spend or number of suppliers. A portfolio analysis can also be used, which results in four general item categories: bottleneck, core competency, leverage, and commodity.

In addition, supplier segmentation is applied within a given category to see how much each given supplier needs the organization's business. The type of category plus this information on relative leverage with the supplier are inputs to determining whether suppliers should be segmented as transactional, preferred, strategic, or owned.

Determining Strategic Importance and Related Factors

Determining the strategic importance and other product or service factors is a prerequisite to conducting a portfolio analysis. Strategic importance depends on cost, quality, delivery reliability, precision, and flexibility. Cost speaks for itself, but cost and quality often are inversely proportional. Quality and delivery reliability are usually measured by number of defects allowed or late orders and are often collectively rated by members of an exchange using supplier history. Precision is measured as degree of variance from specifications. (Small variances in components from different vendors may actually prevent assembly.) Flexibility is the ability of the supplier or manufacturer to deliver in varying quantities when given a specific number of days' notice. These criteria are strongly influenced by several factors related to the product or service: product factors of strategic importance and complexity and availability factors of the number of suppliers and supply uncertainty.

- **Strategic importance.** The primary sourcing consideration is the strategic importance of the product or service. If the company cannot afford to make mistakes, it should produce the item in-house, even if this is more expensive. If the company lacks internal capability, it should form an alliance with one or more companies that can make the item or perform the service. Multiple sources provide a backup. Commodity products, by contrast, are widely available, have little strategic importance, and can be purchased at the lowest available price. This includes modular products and overhead items such as electricity.

- **Complexity.** The next factor is the complexity of the item and of the process steps required to produce it. Strategic alliances may be needed for very complex items simply because of the level of collaborative planning needed to get the item right in the necessary time frame. Examples include military technologies such as missiles. Many contractors may need to form strategic alliances to get all of the components to work together and to provide the appropriate level of security. Airplanes also require alliances for many major systems, although minor systems can be sourced through lower-level relationships.

- **Number of suppliers.** The number of suppliers available for a product or service can determine how much the company should escalate the relationship. When one or very few suppliers are available to produce a required component, the company may need to form a strategic relationship in order to guarantee continued availability of the item. For example, Canon is one of the only producers of high-quality engines suitable for use in laser printers, so Hewlett Packard has a strategic alliance with them for this part even though the two compete on printer sales directly. Focusing only on price or time to market with such a supplier would be a mistake.

- **Uncertainty.** Finally, supply uncertainty is the risk that the good or service may not be available or may have strong fluctuations in price or quality. Even if there are hundreds of suppliers of finished lumber on the market, there may be great variability in quality and in precision of milling. If a manufacturer that uses this lumber advertises its superior quality of lumber as a selling point, then it shouldn’t simply buy from the lowest-price supplier but should develop a partnership with one or more suppliers who can meet these stipulated levels of quality.

Portfolio Analysis

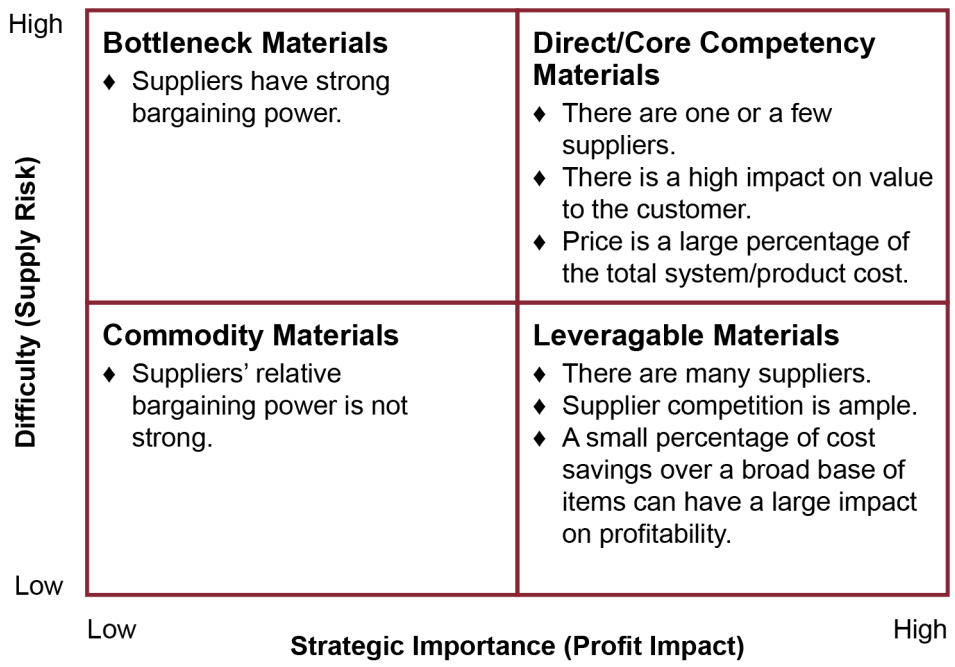
A portfolio analysis is a tool that can be used to segment sourcing into four categories so that the appropriate level of management attention and resources can be applied to the sourcing and procurement processes.

If a partnership requires more than one of the intense collaboration levels noted above—for example, when a material is critical to the product’s quality or there is uncertainty about an item’s availability—then the need for higher collaborative intensity can be termed as “high strategic importance.” Strategic importance can be considered one half of the overall equation. Difficulty, which includes the supply

chain challenges of complexity, number of suppliers, and uncertainty, is the other portion of the equation.

Exhibit 3-7 shows how a portfolio analysis creates four basic categories of goods.

Exhibit 3-7: Portfolio Analysis



Source: Adapted from Designing and Managing the Supply Chain, third edition, Simchi-Levi et al.

This model can be used to determine which suppliers are most appropriate for each of the four types of goods or services:

- **Commodity materials and services are of low strategic importance and low supply chain difficulty.** They require suppliers whose priority is cost reduction. These items are best purchased at arm's length with little negotiation. Which of your suppliers can provide the best cost reduction on the commodity items you need? A key strategy here is to simplify and automate the procurement process for these categories. Rationalizing or right-sizing the supply base is also important.

- **Bottleneck materials and services are of low strategic importance but are of high supply chain difficulty.** A key strategy is to ensure that the need for these items is fulfilled. Therefore some level of ongoing relationship with a particular supplier may be vital. Another goal can be to eliminate the bottleneck by finding or developing more potential suppliers.

- **Leveragable materials and services have high strategic importance but low difficulty.** The key strategy for these high-purchase-volume materials is to determine a set of preferred suppliers one can work with over time to get high and increasing levels of quality, service, objectives compliance, and cost improvement. To achieve these goals, collaboration will be needed to optimize both cost savings and reliability. While consolidation is desirable, one should maintain a healthy amount of competition. Other options include exploiting market cycles or bulk purchasing by multiple members of the supply chain.

- **Direct/core competency materials and services are of high strategic importance and high difficulty.** The key strategy for these goods and services is to form strategic partnerships for longer periods of time to ensure availability and quality. Great suppliers get an increased role in design and more business volume. This area requires detailed negotiations for contracts and contingency plans.

Sometimes companies do not heed these factors and end up buying at arm's length to get the lowest price for items that are critical in one or more of these ways. Sometimes the cost of the process of checking goods for defects or repairing them or for resolving problems with customers after resale is quite a bit higher than the cost savings found by switching from supplier to supplier. Some damage to reputation may be irrevocable but hard to measure. Companies must add these costs to the cost of the product when determining how much they are actually spending.

Segmented Sourcing Strategy

Treating some sourcing relationships as strategic priorities and sourcing all over the globe have increased the complexity of purchasing. From the purchasing organization's perspective, what were once routinely one-time transactions may now be recurring relationships that must be planned, monitored, and measured for their impact on business goals. The best supplier may not be the one that offers the lowest price but rather the one that can collaborate with the purchaser to achieve multiple, interrelated business goals while still offering a desirable total cost of ownership.

A segmented sourcing strategy creates a set of segments for suppliers. A supplier in a given category can be in a transactional, preferred, strategic, or ownership segment. In addition, strategic relationships can have subtypes. Before we explore these types in more detail, we discuss an additional analysis that needs to occur related to how much the supplier needs you as a customer.

How Much Does the Supplier Need You?

In addition to determining how much you need a particular type of supplier based on product portfolio classifications of commodity, leveragable, bottleneck, and core competency, it is also important to determine how much each specific supplier in a given category needs the organization as a customer. This is determined by two factors:

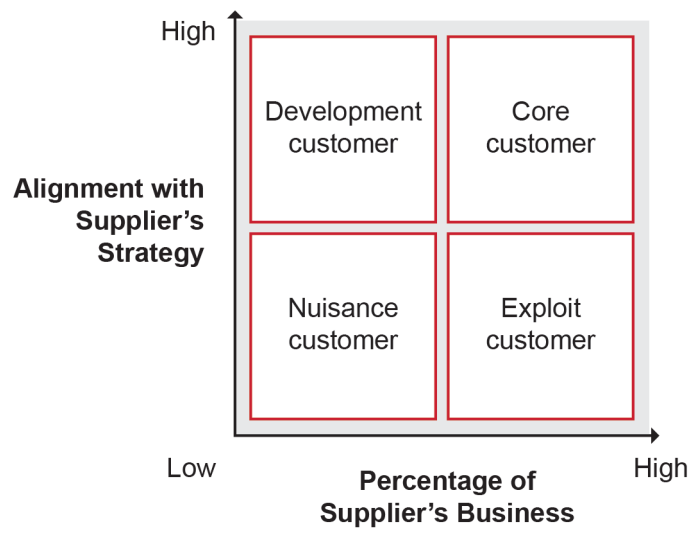
- **Alignment of your purchases with their strategy.** If your purchases are the core thing the supplier sells and wants to sell in the future, you are more important. Other clues include suppliers offering new products or technologies or being responsive to your changing requirements.

- **Percentage of the supplier's business.** According to Monczka, et al., in *Purchasing and Supply Chain Management,* a customer is considered more important if they represent at least five to ten percent of the supplier's business. Related factors include the profit margins that sales to the customer provide, if multiple supplier locations work with the organization, if they provide goods in

multiple sourcing categories, or if they are small and need to highlight the customer's business in their marketing materials.

As shown in Exhibit 3-8, these criteria can be compared on a customer desirability matrix to create four quadrants of customers: core, nuisance, development, and exploit.

Exhibit 3-8: Customer Desirability Matrix



Source: Adapted from Monczka, et al., Purchasing and Supply Chain Management, 7th ed., which cites Aberdeen Group.

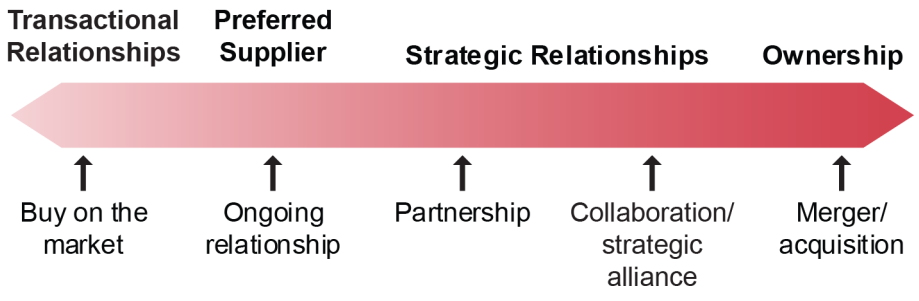
If you are aligned well with a supplier's strategy and are a large share of their business, then you are a core customer. The supplier will make investments to keep you. If the opposite is true for both of these perspectives, you are a nuisance customer. The supplier will not make investments, and you may be ignored. When your account is attractive to the supplier but you do little business with them, you are a development customer. The supplier will work to increase their business with you. Finally, if you are not attractive to the supplier but do a lot of business with them, you are an exploit customer. This type of supplier may raise prices or cut services since you are not part of their long-term plans.

The combination of the analysis of how much you need them plus how much they need you then results in the choice of the appropriate supplier segment.

Supplier Segments

Supplier segments range across a spectrum of buyer-supplier relationships. At one end of the spectrum (shown in Exhibit 3-9) is the traditional transactional supplier segment, or "buy on the market." The next segment is preferred suppliers. These suppliers receive significant spend, which creates some business continuity risk. Preferred suppliers need to be committed to continuous improvement. The strategic relationships segment is next. This segment needs to be a core supplier in terms of how much they need you. Also, what is sourced is a core competency material. Detailed contracts are needed due to the significant risks. At the far end is the ownership supplier segment, or the translation of external supplier relationships into purely internal processes via ownership through mergers and/or acquisitions —a relationship with others essentially becomes a relationship with oneself.

Exhibit 3-9: Spectrum of Possible Business Relationships



Any of these relationships can be global in nature. In developing supply plans, organizations must decide on the optimal type of relationship for each product or component for which a “buy” decision (or “make” in a merger/acquisition) is made.

Note how each of these segments corresponds to one or more relationship types.

Relationship Types

Exhibit 3-10 compares supplier relationship types according to five variables:

- Proximity (How long is the relationship? How narrowly defined is it?)
- Visibility (How much information sharing is occurring? What type of information is being shared?)
- Suppliers’ interaction with competitors (Do they work with many competitors as their clients or have some level of exclusivity with you?)
- Communication (At how many points do our organizations touch and communicate with each other? How much trust exists?)
- Culture (Is there any attempt to share cultures or influence the other culture?)

Exhibit 3-10: Characteristics of Different Types of Supplier Relationships

Relationship	**Characteristics**				
	Proximity	***Visibility***	***Interaction with Competitors***	***Communication***	***Culture***
Transactional: buy on the market	Arm’s length	Technical requirements of purchase	Significant	Computerized interaction	Not an issue
Preferred: ongoing relationship	Medium-term contracts	Some sharing of goals and tactics	Some	Through designated contact points such as account managers	Awareness of culture
Strategic: partnership	Longer-term contracts	Full sharing of goals, strategies, and tactics	Limited	Increased interaction between related departments; some degree of trust	Awareness and adaptation to each other’s cultures
Strategic: collaboration/strategic alliance	Long-term relationship	Full sharing of goals, strategies, and tactics and attempt to reflect partners’ plans in their own	Limited or none	Extensive communication; high levels of trust; enforced via contracts and licensing	Merging of cultures

Relationship	Characteristics				
Ownership: mergers and acquisitions	Ownership	Full sharing of goals, strategies, and tactics as internal, commonly held information	None	Varies	One culture

Buy on the Market

In the “buy on the market” approach to purchasing, organizations buy in response to immediate needs, choosing freely from among all the vendors that can meet those needs. There is sharing of technical purchasing requirements (e.g., specifications and proposal components) rather than strategies or plans.

The relationship is transactional and not ongoing. It is also not exclusive. The purchaser may be buying from competing vendors either simultaneously or sequentially. There may some communication of information electronically (e.g., billing, change orders). These are lower-value relationships, with smaller levels of involvement by both parties.

Ongoing Relationship

An ongoing arm’s-length relationship with traditional suppliers involves repeated transactions, perhaps regulated through medium-term contracts and designation as a preferred supplier. The supplier may learn enough about the purchasing organization to suggest opportunities. Communication is funneled through an account manager who adjusts to the customer’s culture and way of doing business in all interactions. The company may also define a set of criteria to certify some suppliers.

Partnerships

Partnerships use longer-term contracts. A **supplier partnership** is “the establishment of a working relationship with a supplier organization whereby two organizations act as one” (*APICS Dictionary,* 16th edition). The length of the relationship creates opportunities for increased understanding of each other’s organizations and increased efficiencies through greater communication and more value-added services. Business with the competition is minimal.

Collaboration/Strategic Alliance

According to the *Dictionary,* a **strategic alliance** is

> a relationship formed by two or more organizations that share information (proprietary), participate in joint investments, and develop linked and common processes to increase the performance of both companies. Many organizations form strategic alliances to increase the performance of their common supply chain.

This alliance is a long-term arrangement that sometimes operates under blanket agreements or blanket purchase orders rather than by individual purchase orders. Blanket purchase orders are discussed more elsewhere.

The suppliers are fully aware of the purchaser's goals and strategies and work with the purchaser to develop and implement complementary tactics. Contact points exist throughout the organizations, and information flows in an unrestricted manner between the two business entities. The trust level is high, and there is a greater level of involvement by both parties. Either to enhance the collaboration or because the two organizations share similar values, the culture of the supplier may evolve toward that of the purchaser.

Mergers and Acquisitions

In this type of relationship, suppliers are folded into the purchasing entity. Business goals are shared; business areas participate in setting strategy and planning integration of capabilities, processes, and information. Competition has been eliminated. The level of trust, communication, and shared values will vary, depending on the effectiveness of the merger. Some divisions in merged companies retain separate processes and a separate culture that detract from full communication and trust.

Topic 2: Supply Base Analysis and Right-Sizing

Supply base analysis helps determine which categories of purchasing would provide the greatest cost savings because there is significant room for improvement. This information helps with supply base right-sizing, such as consolidating to fewer suppliers.

Supply Base Analysis

A supply base analysis involves using a spend analysis to determine what categories would provide the greatest room for optimization and then conducting supply base market research to better understand the nuances of the given categories being analyzed.

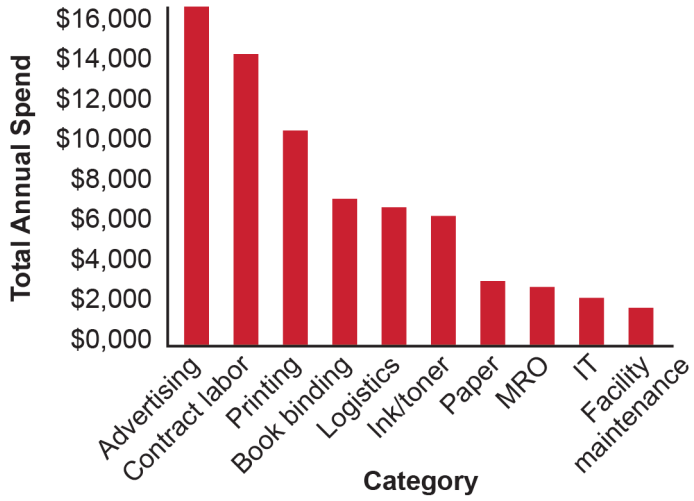
Spend Analysis

A spend analysis is a review of all purchases that the organization makes during a period. It is typically a retroactive review of the prior year. The process can include assessing whether the amounts paid resulted in the right amount of goods and services (i.e., records are accurate, which is important for financial compliance), which suppliers got more of the spend than others, whether classifications such as preferred suppliers were honored, whether departments adhered to their budgets, and whether some different way of consolidating spending with various suppliers would reduce total marketing spend.

Data preparation is key to a spend analysis. This includes consolidating supplier databases (perhaps across different business units or acquired organizations), reviewing the database for duplicates or other issues to be corrected, and ensuring that category and subcategory descriptors for suppliers are correctly assigned.

The supplier list is sorted by category, and from there the list is sorted from highest to lowest amount of spend to find the total spend by category. Note that this is often done in a spreadsheet, and tools such as a pivot table function can enable sorting both by category and category spend. These data can be used to create a Pareto chart, which ranks the top spending categories from highest to lowest, as shown in Exhibit 3-11. This process helps sort out the vital few categories (such as the top 10 spending categories) from the trivial many. (Some of the lower categories might be grouped together in an “other” category.) Even a small improvement in how one of the top categories is managed can result in significant savings. Improvements in lower spending areas will not generate the same bottom-line impact.

Exhibit 3-11: Pareto Analysis of Spend by Category (in Thousands)



Another useful Pareto analysis is to sort the data so that the analysis ranks categories from the most suppliers per category to the least. This analysis can reveal areas where the most benefit can be had from a supplier right-sizing review. Focusing on reducing suppliers in categories with the most suppliers can reduce administrative costs and enable getting price discounts for giving other suppliers more business.

A third Pareto analysis is to sort the data so it shows the average spend per supplier by category, but this time the ranking should be from lowest to highest average spend. This is because the vital few to manage are the categories that have low average spend per supplier. This will complement the prior analysis by showing categories that could benefit from increasing the volume of business per supplier and/or consolidation of suppliers.

The results of a spend analysis can be used for supply plan refinement, such as by determining which categories need a prioritized review. Focusing improvements on areas that can return the most savings while maintaining acceptable levels in other criteria such as quality and risk will provide the most value for the investment.

Supply Base Market Research

Supply base market research starts by gathering internal information on projected demand for the categories being analyzed. This starts with demand forecasts for the products or services that use the given categories. Be sure to consult with internal stakeholders regarding new product introductions or other new sources of demand for the category. The data on demand for end units then needs to be translated into demand for the given supply category. Next, existing suppliers in the category are reviewed. This includes data from the spend analysis such as total annual purchase volume from a supplier, what percentage of the category spend this is, and other details, such as the percentage of business unit spending this represents. Other data on the supplier may be located in the supplier relationship management database.

Once the researchers understand historical demand from the prior year, forecast demand for the upcoming year, and how well a given supplier has performed, it is time to start interviewing key supplier representatives, who are often the best sources of market research. This should include salespersons, line managers, and even their purchasing staff. Determine the degree of capacity they could commit in the next year, and also ask them about the state of their market.

Supply base market research also requires looking at the external market to determine what other suppliers are out there, to validate information on existing suppliers, and to better understand market conditions such as commodity price trends, technology trends, or upcoming regulatory changes.

Sources of external information could come from an expert supplier or consultant who knows the category well. Networking can also reveal additional experts to consult. Published research can be purchased or could be publicly available if from a government source. Trade journals, supplier annual reports, textbooks, trade conferences, and internet research are also useful. It is important to determine whether such sources of information are too dated to be useful. Finding great sources of market intelligence can convey a competitive advantage and so could be worth a significant investment, such as by commissioning a new study from a trusted market research firm.

The key is to get corroboration on any market predictions from multiple sources. Decisions on sourcing can require significant investment, so it is important to get ample justification to support a given set of assumptions.

It is also important to determine what information is the most important to present to decision makers and present just that information in an easily digestible format such as a slideshow or a dashboard.

Supply Base Right-Sizing

Supply base right-sizing or rationalization involves a review of the suppliers in a category to determine the ideal number. Using a different number of suppliers or a higher quality set of suppliers could provide cost savings or other benefits. Usually this involves finding categories with too many suppliers and reducing that number by awarding the business to fewer, more preferred suppliers, especially those

who are willing to provide volume discounts or to commit to ongoing cost improvements or deeper relationships or who can provide a full-service range of products or services.

Note that in addition to improving the quality of remaining suppliers (and having fewer costs of quality) or getting quantity discounts, another key cost-saving opportunity is in administrative costs. Ordering costs and supplier relationship management costs (including problem remediation) will be much lower when fewer suppliers are used. More time can be spent on each supplier when fewer suppliers exist, and this can enable more collaborative relationships.

Different approaches can be used to determine which suppliers to omit and which to retain. A Pareto analysis can be done, and the top 20 percent of suppliers by category spend could be those retained. A set of more rigid supplier requirements could be rolled out to all suppliers with an ultimatum to meet the requirements or be dropped. A triage approach could be used to evaluate suppliers and place them into categories such as unacceptable, minimum qualifying, and world-class performance. A competency staircase approach could be used, which involves setting a series of more and more difficult hurdles for suppliers over time. A key benefit of some of these methods is that the initiative can be used to end contracts with suppliers who have poor performance records or who cannot achieve best-in-class performance. When suppliers who currently a have low volume of business are among the first to be eliminated, this has the benefit of being fast and easy to do, but it is a risk because some of these suppliers may be well worth a greater investment. Research is needed to mitigate this risk.

A SMART (specific, measurable, attainable, relevant, and time-bound) goal should be set, such as reducing the number of suppliers used in the given category by 25 percent over six months, saving $X dollars of purchasing spend. The amount of the reduction should not be arbitrary but instead be based on an assessment of what is the ideal number. Specifying an appropriate time frame is important because in addition to being a measurable goal, ending supplier contracts may require allowing some contracts to expire if other contractually allowed exit criteria have not been met.

While cost reduction is typically the top priority in these endeavors, other organizational goals might also be accommodated, such as prioritizing use of local suppliers or retaining suppliers who meet sustainability objectives. However, one organizational goal that may be difficult to accommodate using this strategy is risk reduction. The number of remaining suppliers in a category needs to be enough to enable continuity of supply, maintain competition in sourcing, avoid becoming too dependent on one or a few suppliers, or risking lack of available capacity. This is why the ideal number of suppliers is not always a lower number.

A supplier right-sizing initiative can work well with outsourcing or offshoring initiatives. After all, the lowest cost or best-in-class suppliers for a given category could be located anywhere. While contracting out will increase total sourcing spend, right-sizing initiatives are more concerned with the efficiency of individual categories.

Right-sizing may be more or less difficult at different points of a product's life cycle. During growth or maturity, there will often be many suppliers, and so this is a key area of focus. However, right-sizing from the start can help avoid many problems in the first place. For example, if a supplier is involved in product design or prototyping, the supplier will be "locked in" to some extent, even if a final contract has not yet been signed for supply of the final material. Involving supply management earlier in new product development can help ensure that the right set of suppliers is selected in the first place, before the supplier has too much negotiating leverage.

Supply base right-sizing could also occur by redesigning products or services to require fewer or different materials. Efforts to reduce product complexity could result in an entire category of purchasing no longer being needed.

Supply base right-sizing is a continuous endeavor. In addition to there being new categories upon which to focus improvement attention, the needs of the organization are continually changing, so new categories can be formed at any time. Finally, any system that is not continually monitored can go back into its old ways. Supply bases grow too large one new supplier at a time. Better enforcement of procurement policies such as use of preferred suppliers can help slow this type of efficiency degradation.

Section C: Product Design Influence

This section is designed to

- Describe the design process and identify the contribution of design to product and delivery costs
- Describe the levels of supplier involvement in product design and explain the trend toward supplier integration
- Contrast traditional over-the-wall design with collaborative design for the supply chain
- Explain the features, benefits, and tradeoffs of various approaches to design, including design for logistics and design approaches that focus on standardization, modularization, simplification, customization, quality, and sustainability.

Influencing product design is a supply chain manager's chance to get things right from the start. An efficient supply chain needs products that are planned, sourced, made, delivered, returned, and enabled with the needs of each of these stages in mind. They may also need to satisfy other goals such as for sustainability. Supply chain managers can help decision makers see that the most effective and least costly time to do this is when the product is being designed.

Topic 1: Product Design

The big picture related to product design is all about how the design process should be collaborative, involving all the functions and partners that are impacted by the product's design. However, in reality, sometimes the design of a product or service is carried out in isolation by one or two departments and without involving supply chain partners. Traditional design takes this over-the-wall approach.

After this discussion, a number of important product design methods are addressed here, including broad-based methods and those that focus on standardization, modularization, and simplification.

Product Design Road Map

Product design is a "process [that] consists of translating a set of functional requirements into an operational product, process, or service" (*APICS Dictionary,* 16th edition).

Design spans all the work between marketing and production. Depending on the industry, the business, and the product, design may involve models and prototypes as well as sketches and plans. Automobiles are sketched, rendered as models, and constructed in prototype for test driving and are subject to design revision at each step in the process. Each component of the finished vehicle must be designed with more than looks and function in mind but also raw materials, sourcing, manufacturing, labor costs, and regulations regarding safety and environmental impact.

Services, too, go through a design phase. Investment portfolios, for example, were once custom-designed for wealthy clients. Today, prepackaged mutual fund portfolios tailored to specific customer desires and sourced from “raw materials” such as stocks, corporate and government bonds, and traded commodities are marketed to a much wider customer base. Bank accounts, guided tours, and personal services such as manicures are all similarly subject to careful design and packaging to make the best use of resources and provide benefits customers desire.

Is good design important? Expenses related to design account for about 5 to 15 percent of product cost. But about 70 percent of delivery cost results from choices made during design. A poor design process can kill a product by forcing its price to unacceptable levels for the quality delivered or by slowing its design cycle and time to market until the competition has the market share.

What aspect of product design needs to be considered when designing a supply chain? The answer is every aspect—because the traits and features of every product will impact the supply chain process in some manner. Design has implications for all the stakeholders in the supply chain, and it should be approached with the supply chain’s key indicators in mind.

Before comparing the traditional design process to a collaborative design process, let’s begin with the end in mind. The end is a well-designed product that customers consider a great value. Attributes such as the following make up that value:

- Functionality, which is all about the fitness for use or ability to satisfy customer requirements. Since customers might want very different things, it is important to carefully define what customer segments you want to satisfy.
- Validity, which can be thought of as the ratio of desired functions to unimportant functions for a given customer segment, relative to the price. Some functions are more targeted to some customer segments than others, so the risk here is trying to be all things to all people and then having to charge so much that no one sees value.
- Efficiency, which is about the ability to be efficient in the design, manufacture, and distribution of the product so the price can be low enough to provide value and profit and time to market can be short enough to enable capturing market share.
- Quality, meaning the product is reliable enough, maintainable enough, available when wanted, and so on. This is also a value judgment relative to price and alternatives.
- Serviceability, which is the ability to maintain the product to keep it useful over its expected life, such as upgrades to firmware/software, availability of spare parts, or self-diagnostic/self-service capabilities.
- Returnability/recyclability, which is how well warranties and return policies/processes are designed and how sustainable the product is at the end of its life.

Traditional Design Process

The traditional sequential design process, once almost universal and still used in some companies, incorporates the corporate organization of separate functional areas separated by imaginary walls. This process often goes like this:

- Marketing sends customer needs and attitude information to engineering along with information on target pricing.
- Engineering incorporates the information into design drawings and schematics and “tosses those over the wall” to production and purchasing, perhaps having created a design incorporating the finest materials and extra engineering features.
- Purchasing sources the materials necessary for production, discovering that some specified parts are not available and others are not affordable.
- Production looks at the design and realizes that it would require expensive process modifications and costly additions to staff and equipment.
- Production and purchasing send the designs back to engineering for revisions.
- After several rounds of sending the designs back and forth to various areas, engineering delivers a workable design and production creates a product that logistics is expected to deliver.
- Logistics discovers that packaging and shipping costs exceed the original budget and that the system lacks capacity to get the product to market on time.
- And so it goes until the finished, packaged product arrives at the distributor.

This traditional process can result in problems being unknowingly built into the product design. For instance, certain product designs may increase inventory holding or transportation costs relative to other design options, while other designs may require a shorter manufacturing lead time than is feasible.

Collaborative Design Process

Collaborative design breaks down walls between departments and supply chain partners. Here’s how the design team project commonly unfolds:

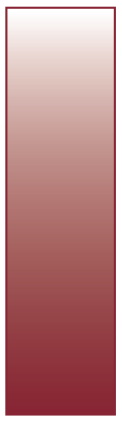
- A design team forms, including members from engineering plus other departments and, perhaps, other supply chain partners.
- The design team considers issues that will arise along the supply chain from raw material to the final stage of the product’s life cycle, making rough approximations of cost differences between alternatives.
- Once all functions and partners have agreed upon a design, engineering, purchasing, and production go to work to bring the design to fruition.

How Much Collaboration?

Because organizations can choose the level of involvement they desire from any given supplier or customer, collaborative efforts in product design extend along a continuum. expresses the range of

supplier or customer integration as going from over-the-wall design, to informal collaboration, to formal collaboration.

Exhibit 3-12: Spectrum of Approaches to Design



Over-the-wall approach: The supplier/customer plays no role in design.

Informal collaboration: Design includes information from conversations or informal consultation with the suppliers/customers but no formal collaboration.

Formal collaboration: The design team involves representatives of the supplier/customer in a formal collaboration. This may involve anything from using the voice of the customer (VOC), to getting regular formal input on a design, to asking a supplier to design a subcomponent due to specialized expertise.

Once the decision is made to forego the over-the-wall approach and instead develop a collaborative approach to design, the question becomes “How much collaboration?” Contributions can be as casual as tips provided in conversation or as formal as fully integrated inter-organizational teamwork with assigned roles and responsibilities.

In a study of supplier integration funded by the U.S. National Science Foundation and the Global Procurement and Supply Chain Benchmarking Initiative at Michigan State University, researchers identified several general levels of supplier integration and assessed the value of each. The results of a survey conducted during the project showed that greater levels of supplier involvement produced, on average, greater improvements in cost and quality.

While one study doesn’t constitute a definitive analysis, it’s fair to say that the trend in designing for the supply chain is toward formal supplier collaboration and away from the over-the-wall and informal approaches. This is true for the involvement of customers in design as well. Involving representatives of key customers in design or collecting the broad input of many smaller customers using the voice of the customer and other methods will benefit from a formal process to ensure that customer requirements and expectations are represented in the design. It makes sense that the more functions and partners contribute to a design, either casually or in formally organized teams, the better chance you have of getting a product or service that is actually desired by the market into production at a reasonable cost and on time.

Note that while suppliers or customers may be asked to be part of a design team, the organization whose brand is at stake should retain responsibility for the overall design rather than allowing anyone else to take the lead.

Implementing Design Collaboration

Busy managers have tight deadlines, and designers and marketing managers often have performance scorecards that fail to reward supply chain cost reductions. Therefore, a process is needed to gain both

internal and extended partner acceptance for design process improvements.

Cargill and Fry describe such a process used at Hewlett Packard, which is paraphrased here:

- **Proof of concept.** Small projects are performed, harnessing experts and internal staff to test the concept. Successes are celebrated and internally advertised. Simple graphics are used to make the goals easy to understand and accept.
- **Formalize concepts.** Terms are standardized, concerns are addressed, case studies are shared, and formal training and online at-will training are created to educate staff and partners.
- **Formalize processes.** Cross-functional teams are created, and individuals are assigned to work a percentage of their time on the teams. Performance metrics, scorecards, and rewards such as formal praise are implemented. Experts are made available.
- **Prioritize opportunities based on best value to encourage adoption.** Concepts that have proven the most effective are pushed to other teams.

In this way, internal teams and external partners can be led a step at a time toward appreciating the financial and other benefits of collaborating on design, finding real ways to make these concepts work for them, and finally incorporating collaboration into normal processes so that efforts can turn to sustaining and continuously improving the effort.

Benefits of Design Collaboration

Integrating suppliers and customers into the design process provides many potential benefits, including those that follow:

- **Fewer cost overruns.** Collaboration with the supplier brings greater clarity about manufacturing processes and materials, reducing the likelihood that designs will be impractical to manufacture. Collaboration with customers can help prioritize which design elements to include or exclude.
- **New and improved approaches to design.** The supplier brings special expertise in processes, materials, and technologies that can give the designers new ideas and avoid problems caused by reliance on expensive or hard-to-find parts. Customers can indicate if a new process would be perceived as value-added.
- **Improved customer satisfaction.** Collaborating with the supplier in the testing of prototypes, models, and preproduction samples reduces the number of product failures. Involvement of customers aligns products with actual customer needs.
- **Improved efficiency (faster to market).** The supplier’s experience in manufacturing and logistics can lead to products that are more easily manufactured, assembled, shipped, and stored. Customer involvement can keep the focus on actual requirements.

- **Higher product quality for the price.** Sharing quality requirements with the supplier before final selection of parts and processes results in higher quality and more affordable pricing. Customers can indicate the price/quality level they are willing to pay for.

By including perspectives such as those of marketing, production, and supply chain management, designers can develop products that are better matched to customer needs, cheaper to build, easier to transport and store, and easier on the environment.

provides a summary of various approaches to design collaboration. These include both broad-based and more specific methods. Note that quality, customization, and sustainability are addressed in a different area.

Exhibit 3-13: Summary of Design Methods

Broad-based methods ♦ Design for supply chain ♦ Design for logistics ♦ Design for X (DFX)	**Quality** ♦ Design for quality ♦ Design for six sigma ♦ Quality function deployment (QFD)
Standardization and modularization ♦ Modular design ♦ Component commonality ♦ Universality	**Customization** ♦ Postponement ♦ Mass customization ♦ Glocalization
Simplification ♦ Concurrent engineering ♦ Design for manufacture and assembly (DFMA) ♦ Design for service	**Sustainability** ♦ Design for the environment ♦ Design for reverse logistics ♦ Design for remanufacture

Broad-Based Design Methods

There are a number of broad-based approaches to product design, all of which are focused on improving different aspects of the supply chain design. We'll take a closer look at three broad-based design approaches: design for the supply chain, design for logistics, and design for X (excellence or everything).

Design for the Supply Chain

Design for the supply chain refers to "enhancement of a firm's product design in consideration of the issues that will arise in the supply chain, from raw materials to the final stage of the product's life cycle" (*APICS Dictionary,* 16th edition).

The need to meet supply chain goals of faster inventory turnover, lower inventory costs, reduced inventory transit time, and quicker time to market has inspired modifications to the design process. Design for the supply chain incorporates concepts of design related to supply chain standardization, simplification, customization, quality, and sustainability, each of which is discussed in its own area.

Design for Logistics

A term closely related to design for the supply chain is design for logistics (DFL). Adding logistics to the design agenda assumes that the supply chain and the product are designed simultaneously to optimize efficiency, affordability, and quality.

Design for logistics is concerned with minimizing supply chain costs by

- Designing to minimize transportation and storage costs: efficient packaging for fast loading/unloading and higher density of items per pallet
- Designing to minimize manufacture and assembly time
- Designing to maximize standardization.

The first of these principles is discussed next, while design for manufacture and assembly and standardization are discussed elsewhere.

Design to minimize transportation and storage costs may involve designing products to fit into standard box sizes (full size, half size, quarter size, etc.) so that different boxes can fit in a master carton or on a pallet efficiently. This process is called unitization or containerization. For example, four six-packs of beer can be designed to fit into a master carton that holds 24 cans and stacked along with 24-packs. This process allows different assortments to be shipped together. Master carton design should also facilitate loading and unloading by hand without mechanical assistance when feasible.

Changing product designs and how items are packed can also reduce overall box sizes. For example, designers could reinforce a product's internal frame so it requires less cushioning material or store a cable within a printer output tray instead of increasing the packaging. Such size reductions can have huge cost savings, for example, being able to fit an additional row of goods on each pallet.

Examples of design for logistics abound in retail stores. Plastic garbage pails that can be stacked one inside the other are a result of DFL. Since they are made of plastic rather than metal, they are lightweight for ease of transport. When nested, they occupy much less storage space and are more economical to ship. Many other products now come in kit form for similar reasons. Ikea's products, for example, are shipped unassembled in flat cartons for efficient handling and storage. One unit in each size can be set up in the store for viewing, and customers have easier transportation home. The customer home is the final manufacturing work site.

Benefits

Benefits of the transportation and storage component of design for logistics include the following:

- Lowering transportation and warehousing costs increases profit margins.
- Warehouses can store more goods, relieving capacity pressures.
- Recognizable master carton design helps retailers when looking for a particular item to restock from storerooms.
- Packaging design can allow some retailers to sell directly from a pallet.

Tradeoffs

Tradeoffs of the transportation and storage component of design for logistics include the following:

- Maximizing items on a pallet needs to be balanced against the needs of retailers; slow-moving goods may not be desired in larger quantities.
- Product requirements may make standard box sizes problematic.
- The density of items may need to be altered to balance between maximum vehicle volume (“cube out”) and vehicle weight restrictions (“weigh out”).

Design for X (DFX)

The *Dictionary* defines **design for X (DFX)** as follows:

> Also referred to as design for excellence, a design process that ensures the outcome is manufacturable, maintainable, cost effective, and high quality.

Design for X is sometimes called design for everything to describe a need to design a product or service with all of the design considerations that an organization determines are of strategic importance. For example, a particular organization could decide that its critical design goals include universality, design for manufacture and assembly, quality function deployment, postponement, and design for reverse logistics. Each organization will set its own priorities.

Standardization and Modularization

Standardization is “the process of designing and altering products, parts, processes, and procedures to establish and use standard specifications for them and their components” (*APICS Dictionary,* 16th edition).

A related term is **standardized product ,** which is “a product that can be made in large quantities, or continuously, because of very few product designs” (*Dictionary*). When the standardized product is production equipment, it is called procurement standardization, meaning that equipment is designed to allow for design variance and adaptation to new customer demands.

Standardization works hand in hand with modularization, which is the standardization of product components into modules that can be assembled into a wide variety of products that are still essentially standardized.

An important step for design teams to take when pursuing standardization and/or modularization is to look at existing product families. Creating a common component or module that will work for an entire line (or using one that was already created for those lines) will multiply the savings from standardization. For example, when Hewlett Packard merged with Compaq, it found that its server racks had incompatible shapes. Customers didn’t place any value on the difference. Hewlett Packard

reduced this number to from 12 to five types of kits, for an estimated product lifetime savings of US$32 million.

Types of standardization or modularization include modular design, component commonality, and universality.

Modular Design

A module is a part that can be used in multiple products. According to the *Dictionary,* a **modular design strategy** is

> planning and designing products so that components or subassemblies can be used in current and future products or assembled to produce multiple configurations of a product.

Modular design is also called modularization. The *Dictionary* defines **modularization** as follows:

> In product development, the use of standardized parts for flexibility and variety. Permits product development cost reductions by using the same item(s) to build a variety of finished goods.

Modular design is a type of component commonality, and the terms are sometimes used interchangeably.

In addition to design for component reuse, modular design can start by considering existing products on the open market to avoid design and manufacture costs for those parts.

Computers provide a perfect example of modularity. RAM, hard drives, and graphic and audio subsystems are interchangeable among many different computers. Some computer parts—hard drives and RAM, for example—can be added to a machine as upgrades, or they can be replaced with new, improved components. Modular bookshelves that can be stacked vertically or integrated horizontally to fit different spaces provide another example.

The opposite of modularity is integral design, in which all components are designed to work together in one specific product. Apple computers focus on integral design, while PCs are modular. Clothing can also illustrate the two types. Trousers, shirts, ties, and sport coats can be mixed and matched because they are modular. A uniform, on the other hand, is an example of integral design.

Services can be modular, too. An *à la carte* menu exemplifies modular design; the special of the day, with all courses determined by the chef and the price set by the house, is an integral design. Breaking down a process can allow various components to be outsourced. For example, some McDonald’s restaurants rely on (possibly offshored) call centers to take drive-through orders to decrease the time involved in filling orders. The call center relays the order to the kitchen with a customer photo to assist in accurate delivery at the drive-up window.

Benefits

Benefits of modular design include the following:

- Reduced cost of design and manufacturing when using modules to create a family of products, possibly leveraging postponement strategies
- Increased efficiency and decreased cost of production, since multiple products can be created simultaneously from the standard components
- Expanded customer base, because products can be customized closer to the end user (and sometimes by the end user)
- Easier, more cost-effective shipping, warehousing, and display of the product if it is designed with packaging in mind (e.g., boxed furniture kits)

Tradeoffs

There are potential tradeoffs involved in taking a modular approach to design:

- While modular design may reduce logistics costs, the cost of each product in a family may go up.
- Errors in module assembly can create a poor end-user experience.
- Integral design generally allows more emphasis on style, beauty, quality, “fit and finish,” user experience, and customization. Costs can be higher, but it can be a source of competitive differentiation so a higher price often can be charged.

Component Commonality

Component commonality is a form of design standardization where a single part is used to replace a variety of similar parts. For example, instead of using a variety of bolt sizes in an assembly, the assembly can be designed in such a way that the same size bolt will work for all purposes.

Benefits

Common components can increase efficiency and lower costs in several ways:

- Lower purchasing costs because less variety allows economies of scale
- Streamlined production because of fewer process and tool changes
- Simpler, cheaper storage with less room for errors

Tradeoffs

Tradeoffs include the following:

- Cost of product modifications required to accept the new part
- Less flexibility for designers, who may prefer a variety of similar parts
- Less quality if the greater variety of parts would, for example, allow closer tolerances or more attractive design

Universality

Universality is “the strategy of designing a product initially intended for one market in such a way that it can also be sold in other markets” (*Dictionary*). Being a form of standardization, “one-size-fits-all” items exemplify universal, or standardized, design, as do unisex clothes. Sometimes astute marketing can convert a specialized product into a universal one. For example, restaurant-quality kitchen appliances have become popular in homes. Universality can be used for product components, too. For example, power supplies can be made to accept either 110 or 220 power for use in different countries with only a different end cable.

Benefits

Benefits of universal design include

- Increased sales volume
- Reduced design and manufacturing cost compared to market-specific items.

Tradeoffs

Universal designs may be less suited to any given market than a specialized product would be. This can translate to a shorter product life cycle and less customer loyalty.

Simplification

Simplification is “improving quality and cutting costs by removing complexity from a product or service” (*APICS Dictionary,* 16th edition). Less complex products and services have shorter lead times, fewer quality issues, and higher profit margins. Simplification provides synergy with other design approaches such as standardization or customization as well as with manufacturing approaches such as build-to-order.

Types of simplification include concurrent engineering, design for manufacture and assembly, and design for service.

Concurrent Engineering (CE)

One of the first steps along the path toward supply-chain-oriented design is sometimes called concurrent engineering (CE). Originating in the 1980s, CE has also been called simultaneous engineering or participative design. Whatever the name or particular tactics, concurrent engineering starts from the premise that the product design processes can be shortened and simplified when stakeholders other than just engineers contribute. Variations on that theme are known as early manufacturing involvement and early supplier involvement (ESI). Manufacturing and supplier representatives can be on a design team together, plus marketing and sales, service, and purchasing.

Benefits

Benefits of concurrent engineering include the following:

- Emphasizes design collaboration

- Shortens the design cycle when events are parallel rather than sequential
- Can use collaborative design tools such as interactive design tools for virtual meetings

Tradeoffs

Concurrent engineering has been replaced by more complete methodologies such as design for manufacture and assembly.

Design for Manufacture and Assembly

According to the *Dictionary,* **design for manufacture and assembly (DFMA)** is

> a product development approach that involves the manufacturing function in the initial stages of product design to ensure ease of manufacturing and assembly.

DFMA is essentially a further development of concurrent engineering. A related term in the *Dictionary* is **design for manufacturability ,** which is the “simplification of parts, products, and processes to improve quality and reduce manufacturing costs.”

DFMA acknowledges the benefits of including suppliers, manufacturing engineers, and warehouse managers responsible for assembly in the design process. When these other stakeholders review the design as it is being created, they can draw upon their experience and firsthand knowledge of existing manufacturing/assembly processes to catch unrealistic assumptions about production while design change is relatively easy. (Correcting flawed design assumptions is much more costly and time-consuming after the design has been completed.) The result is a high-quality product that remains affordable and is ready for market quickly.

The goals of DFMA are as follows:

- To select materials for ease of production as well as product function
- To design components so that they do not require extremely tight tolerances
- To reduce the number of parts
- To reduce the number of instances parts need to be handled
- To use concurrent and parallel processing to reduce work-in-process time
- To make assembly obvious and easy
- To simplify the process steps for assembly
- To design in easy product testing

For example, a U.S.-based pinball machine manufacturing company followed DFMA principles by creating a completed internal assembly harness that could be rotated 360 degrees, giving troubleshooters access to all of the internal wiring for fast repair when performing product testing. Such innovations help them stay competitive with lower-cost labor markets.

Benefits

The benefits of DFMA include the following:

- Confusion, complexity, and variability are reduced, in turn reducing production delays, long setup times, and extensive training requirements.
- Standards and policies, such as requiring evaluation of existing equipment before resorting to a new production line, can enforce DFMA.
- DFMA makes use of standardization, such as common parts for product families or off-the-shelf parts, whenever possible.
- It assists lean philosophies, modular design, and mass customization.
- Software automates many features of DFMA.

Tradeoffs

The main tradeoff of DFMA is that it could be at odds with customer demand and marketing desires if simplifications result in some demanded features being omitted. (Usually these are features that fail to increase marginal profits.)

Design for Service (Design for Maintainability)

Design for service is the “simplification of parts and processes to improve the after-sale service of a product” (*Dictionary*). It is also called design for maintainability.

Once a purchase has been made, customers’ opinions of a product often hinge on their most recent experiences with it, so serviceability or maintainability strongly impact customer satisfaction and retention of lifetime customers. For products that require regular maintenance, this may involve changing cartridges, filters, or other replacement parts. Parts that need to be replaced frequently should be easily accessible and replaceable by someone with no training. Even when the parts are designed to be replaced by professionals or service teams, faster service reduces maintenance charges.

Benefits

Design for service lowers the total cost of ownership. For example, if a facility manager can replace all air filters in a building in a day rather than two days, it saves the organization a great deal of money over the life of the building.

Design for service also extends to logistics, since a ready supply of replacement parts must be available. Replacement parts can be a significant source of profit. If the ordering experience is easy, it can be a source of customer satisfaction.

Tradeoffs

Design for service may compete with other design goals such as aesthetics or minimizing development cost.

Topic 2: Quality, Customization, and Sustainability

Product design methods can focus on quality, customization, or sustainability. Each of these design focus areas has specific methodologies that can be adopted.

Quality

Quality is defined by the *APICS Dictionary,* 16th edition, as follows:

> Conformance to requirements or fitness for use. Quality can be defined through five principal approaches: (1) Transcendent quality is an ideal, a condition of excellence. (2) Product-based quality is based on a product attribute. (3) User-based quality is fitness for use. (4) Manufacturing-based quality is conformance to requirements. (5) Value-based quality is the degree of excellence at an acceptable price. Also, quality has two major components: (1) quality of conformance—quality is defined by the absence of defects, and (2) quality of design—quality is measured by the degree of customer satisfaction with a product's characteristics and features.

In other words, quality is a critical issue in product design and manufacture that can be measured and controlled in multiple ways. Methods of incorporating quality into design that are discussed next include design for quality, design for six sigma, and quality function deployment. Design for ergonomics would be another example; it is not addressed further in these materials.

Design for Quality

The *Dictionary* defines **design for quality** as

> a product design approach that uses quality measures to capture the extent to which the design meets the needs of the target market (customer attributes), as well as its actual performance, aesthetics, and cost.

Design for quality uses a number of measurements to control quality. Each organization will determine the measurements they wish to use and then set requirements for acceptable quality and goals for exceptional quality. Some of these measurements will be subjective, such as for aesthetics.

Benefits

Benefits of design for quality include the following:

- Fewer defects reduces waste and increases customer satisfaction.
- High quality can move the product from an order qualifier to an order winner if the organization's strategy is to compete on quality.

Tradeoffs

Tradeoffs of design for quality include the following:

- Quality may involve significant initial expense.

- Over time quality usually lowers total costs, but these savings may be hard to trace back to the quality program.

Design for Six Sigma

Design for six sigma is defined by the *Dictionary* as

> an approach to designing products and processes that attempts to ensure the firm can provide products or services that meet six sigma quality levels. These quality levels correspond to approximately 3.4 defects per million opportunities.

Six sigma is addressed in more detail within the context of continuous improvement.

Quality Function Deployment

Quality function deployment (QFD) is defined by the *Dictionary* as

> a methodology designed to ensure that all the major requirements of the customer are identified and subsequently met or exceeded through the resulting product design process and the design and operation of the supporting production management system.

QFD is more than just a design for quality philosophy; it extends to operations and support functions. However, QFD must start with design by translating customer segment demand data and the voice of the customer into design requirements. QFD uses precise steps and a methodology such as the “house of quality,” which is essentially a comparative spreadsheet that ranks how a product or service stands up to customer wants as well as to what the competition is offering. All of this is translated into a set of technical specifications to meet customer priorities. The philosophy uses group decision making to make sure that conflicts are resolved with the customer in mind.

Benefits

Benefits of QFD include the following:

- Provides all of the benefits of design for quality
- Improves customer service
- Shows relative levels of interactions between desired product characteristics so they can be prioritized when in conflict with one another (e.g., light and sturdy or fast acceleration and low gas mileage)

Tradeoffs

One issue with QFD is that, like any complex methodology, it requires the organization to wholeheartedly champion, adopt, and maintain it.

Customization

Customization is a design goal that allows products or product families to be adapted to changing customer demand over time. Customization that requires engineering-to-order has a very high product cost and long lead times. While this is appropriate for some markets, it cannot be profitable for many products and services. Therefore, methods of customization have been developed to harness mass production as much as possible.

Customization methods include postponement, mass customization, and glocalization.

Postponement

Postponement , also called delayed differentiation, is defined in the *APICS Dictionary,* 16th edition, as

> a product design or supply chain strategy that deliberately delays final differentiation (i.e., assembly, production, packaging, tagging, etc.) until the latest possible time in the process. This shifts product differentiation closer to the consumer to reduce the anticipatory risk, eliminating excess inventory in the form of finished goods in the supply chain.

The *Dictionary* defines **product differentiation** as

> a strategy of making a product distinct from the competition on a nonprice basis such as availability, durability, quality, or reliability.

With postponement, the basic product or a set of components remains in undifferentiated form as long as possible before being converted or assembled into a customized, or differentiated, configuration. Sometimes differentiation doesn't occur until the end customer selects the specific components to be assembled-to-order.

Postponement is an excellent example of a push-pull strategy, where the organization designs the product and manufacturing process so that differentiation can be delayed as long as possible. A generic product or set of modular elements is produced at the start of the manufacturing process and, when demand is determined, only then is it differentiated to a specific product (such as by assembling specific modular components). With this strategy, production starts can be based on aggregate forecasts or actual orders. Thus postponement addresses the uncertainty relative to final demand even if forecasts can't be improved.

Benefits

Benefits of postponement include the following:

- Postponement is a countermeasure against the bullwhip effect because it reduces the need for safety stock in multiple varieties.
- The amount of in-transit (pipeline or transportation) inventory is reduced, lowering insurance and handling costs and increasing cash flow.

- Materials needed only locally can be locally sourced and produced to assist with corporate social responsibility initiatives.

Tradeoffs

Tradeoffs of postponement include the following:

- Requires process, equipment, product, and packaging redesign capital expenditures
- Can actually increase costs if there are few varieties of the end product

Mass Customization

Mass customization is the practice of moving final product configuration closer to the customer while still maintaining economies of scale in manufacturing. The *Dictionary* defines it as

> the use of mass production techniques to create large volume of products in a wide variety keeping production costs low while enabling customized output primarily utilizing postponement or delayed differentiation.

A classic example of mass customization is Hewlett Packard's decision to stop sending completely assembled, regionally differentiated printers from one plant to all geographic markets and instead to ship modular parts to each regional distributor for assembly closer to the customer.

Mass customization benefits from modular design, as shown in this HP printer example. The fewer the modules to be shipped, stored, and assembled, the more efficient the supply chain—and the more easily the final differentiation can be accomplished. University education, investment portfolios, and restaurant meals are all customized for the individual end customer. In fact, the customer may do the customizing.

Making mass customization work efficiently depends upon establishing instantaneous communication among the units that build or supply each module. It may also require the availability of considerable expertise at the point of differentiation, either developed in house or developed as a requirement for a 3PL/4PL. In the HP example, the regional distributors had to acquire the equipment and expertise to assemble printers; before this they only had to warehouse and distribute the printers.

Mass customization may also require more expertise by employees at the point of sale, since customers may have to be guided in their selection of custom products. Moreover, the retail salesperson may be the final assembler. It takes greater training, and perhaps aptitude, to build items to order in a retail setting than to sell them supplied as a finished product.

Benefits

Benefits of mass customization include the following:

- Savings due to economies of scale
- Increased efficiency and expertise of workers who learn assembly roles

- Increased sales volume because of the appeal of differentiated products to different market segments
- Reduced inventory costs, because aggregation of demand increases the accuracy of forecasts and allows each region to reduce its inventory
- Creation of semiskilled jobs to benefit local communities

Tradeoffs

Tradeoffs of mass customization include the following:

- Costs of investing in equipment and training to enable distributors to assemble the product
- Potential friction with distributors who don't want the added tasks
- Potential for quality issues if assemblers are poorly trained or designs fail to make assembly foolproof

Glocalization

Organizations can meet the particular needs and wants of different markets around the globe either by designing new products or services or by modifying or redesigning existing ones. **Glocalization** is a hybrid term based on the words globalization and localization, coined by Japanese economists in the 1980s and popularized by sociologist Roland Robertson. According to the *APICS Dictionary,* 16th edition,

> when used in a supply chain context, glocalization is a form of postponement where a product or service is developed for distribution globally but is modified to meet the needs of a local market. The modifications are made to conform with local laws, customs, cultures or preferences.

Glocalization is similar to a **multicountry strategy**, in which "customers have unique product expectations that are addressed by local production capabilities" (*Dictionary*).

Here are some examples of glocalized products from international companies:

- Some fast-food restaurant chains "glocalize" their menus. For instance, McDonald's offers different menus to correspond to the tastes of the community or region. In India, they offer more vegetarian options; in Israel, they serve kosher food. Pizza Hut in Macao, China, offers squid rather than pepperoni.
- General Electric's handheld electrocardiogram device and a portable PC-based ultrasound machine were developed for rural India and China to provide improved quality, increased access, and less cost. Rural patients no longer have to choose between going to urban medical providers and going without medical care.
- MTV, an international cable and satellite television channel, customizes its broadcasts of popular music and promotional music videos to appeal to audiences of all ages and tastes in about 150 countries and nearly 20 languages.

- Unilever has created more than 400 brands of food and health products that it markets around the globe. One product in particular, mayonnaise, is formulated differently for the variations of tastes preferred by people in the Netherlands, Belgium, and France.

Need for Reverse Innovation

According to a *Harvard Business Review* article, “How GE Is Disrupting Itself,” glocalization was successful when wealthy nations comprised the majority of the market and less-developed countries didn’t have much to offer. The authors state that this period of glocalization is over and multinational corporations now need to put effort and funds into global reverse innovation to enable ongoing sales in these countries. Reverse innovation involves developing innovative new products that meet specific needs and budgets of customers in particular markets using a decentralized, local-market focus.

According to the article, the following are two glocalization “assumptions” that General Electric learned are in fact not true and that need to be updated:

- GE had assumed that emerging economies would evolve the same way as wealthy economies. In fact, developing countries don’t evolve the same way, because they are more willing to adopt breakthrough innovations and they have less money to spend. So, for instance, innovations in low-cost medical devices, alternative wind and solar power, and water desalination are becoming more abundant in emerging markets. In another example, some countries without well-developed telephone lines or good electrical grids are skipping the telephone poles and are instead installing cell towers and use solar power for phone charging.

- GE had believed that products that address developing countries’ unique needs would not be sellable in developed countries. Instead what has been demonstrated is the ability of these products to create brand-new markets in developed nations. They are able to do this successfully due to their significantly lower price points and novel new applications.

GE has embraced reverse innovation and has experienced positive results: It created and placed numerous local growth teams. These teams have helped GE better customize product objectives, customer training, and key metrics.

Sustainable Products and Services

Here we look at some sustainable design processes, including design for the environment, design for reverse logistics, and design for remanufacture.

Design for the Environment

Design for the environment (DFE) requires “considering health, safety, and environmental aspects of a product during the design and development phase of product development” (*APICS Dictionary,* 16th edition). It has become a feature of product design due to customer demand for sustainability,

increased government regulations, and a greater organizational focus on corporate social responsibility. DFE aims to create a product that lives and ends its life cycle economically, with the least damage to the customer, the company, and the environment.

Design for the environment includes the following considerations:

- **Provision for reuse or recycling.** Rapidly increasing garbage is one unfortunate feature of the consumer society. Service stations and other businesses that sell motor oil in the United States must agree to receive used oil and recycle it—for a fee. Germany requires domestic beer brewers to use refillable bottles. Reuse is generally easier on the environment than recycling, since it involves less (or no) processing, but using recyclable materials is better than design for the landfill.
- **Reduced energy consumption.** Collaborative teams can design products that use less energy—such as the hybrid gas/electric automobile or an energy-efficient appliance. Manufacturing engineers and logistics specialists can also contribute to designs that take less energy to build and transport.
- **Avoidance or mitigated danger of hazardous materials.** Design can make some products less hazardous—taking lead out of paint and gasoline, for example. For inherently dangerous products, designers can consider how to mitigate the hazard. Cars, for instance, can be designed to lessen the likelihood that gasoline in their tanks will explode in a collision—and all along the supply chain, right up to the pump that dispenses gasoline in the service station, careful design of facilities and instruction of handlers can reduce product hazards.
- **Use of lighter components and less material.** When it comes to environmentally friendly products, less is definitely more. A lighter-weight car gets better mileage. Lighter products have fewer materials in total and lower transportation costs.

Benefits

Potential benefits of design for the environment include the following:

- Consistent with supply chain management's total product life cycle focus
- Enhanced corporate reputation and resulting goodwill
- Limits on corporate liability and legal costs related to environmental issues
- Increased marketability among ecology-minded consumer segments

Tradeoffs

Tradeoffs of design for the environment include the following:

- Increased manufacturing expenses and higher price to the consumer
- Reduced safety and convenience when some products are small and light
- Reduced longevity of natural, less-processed products

Design for Reverse Logistics

Supply chain managers are aware of the need to reduce the cost of reverse logistics, or the reverse supply chain, which handles products that need to be returned, repaired, replaced, or recycled.

This implies several imperatives for the design team. Product packaging can be designed to account for common consumer frustrations such as not knowing to install a SIM card before a cell phone will start working. Clear instructions or a help line can reduce the number of returns based on user error.

If the product has to be returned for repairs or replacement, the process of doing so should be simple for the user. This might include ease of disassembly for repairs, an affordable warranty program, a box that can be used for shipping and return, well-trained and accessible customer service personnel, and comprehensible instructions—as well as a product designed to endure.

Benefits

Potential benefits of design for reverse logistics include the following:

- Customer loyalty from ease of repair, replacement, return, and recycling
- Lower cost of returns
- Improved product designs through attention to reasons for returns

Tradeoffs

An issue in design for reverse logistics is that this is a complex system that can often be underestimated. It may not be able to use the forward supply chain logistics infrastructure and has added costs such as warranty expenses and restocking fees.

Design for Remanufacture

Design for remanufacture is defined in the *APICS Dictionary,* 16th edition, as

> products developed in a manner that allows components to be used in other products. This process is associated with green manufacturing.

Design for remanufacture involves a strategic decision during the design phase of a new product to enable remanufacturing the product for resale. In general, 70 percent of the cost to build something new is in the materials and 30 percent is in the labor. Using remanufacturing, companies can effectively address the larger cost component by reclaiming products after they have been used for one or more life cycles.

With material and resource costs expected to increase, the cost advantage of remanufacturing lies in the fact that items normally discarded can become raw material for the next product life cycle, eliminating waste and closing the loop on the system. In addition, environmental laws that are being instituted in the European Union and elsewhere may force companies to embrace remanufacturing as a sustainable practice.

Remanufacturing is a service business as well as a product business. For the process to work, companies have to form a replacement relationship with customers. For example, Caterpillar, the heavy equipment company, has created a separate division for remanufacturing. When a customer replaces a product, they are offered a remanufactured one for about half the price. However, the customer will be charged full price until he or she turns in an old product—one that is inspected and certified as remanufacturable. Thus, customers benefit by becoming Caterpillar's partner. Customers are actually creating assets, in the form of returned products, for their supplier. In return, they receive less expensive replacement parts, so they can keep their fleets running with minimal downtime.

Benefits

Proven characteristics of design for remanufacturing include lower cost to the customer, lower impact on the environment, and lower product development costs. Also, the increasing costs associated with materials and resources and environmental laws make remanufacturing an attractive option for various companies.

Tradeoffs

The primary tradeoff of remanufacturing is that rather than receiving full cash, the manufacturer receives parts as partial payment, so cash can be tied up in inventory longer. Note also that in the U.S., and possibly elsewhere, a remanufactured product cannot be sold or marketed as a new product.

Section D: Supplier Selection, Contracting, and Use

This section is designed to

- Trace the purchasing process, including supplier selection, negotiation, order placement, and other follow-up and feedback steps
- Define supplier selection criteria and needed supplier value-added services or sustainability requirements
- Describe how to use effective negotiation skills to get the most out of relationship management
- Explain how to deploy and manage contracts to ensure that all parties are living up to mutual agreements
- Describe basic types of contracts
- Discuss terms and conditions of contracts that promote relationship building and maintenance on the part of both parties
- Explain the process and considerations for foreign currency contracts
- Track the status of open orders in various internal functional areas
- Understand how invoices are reconciled and approved
- Understand the options available for expediting and why expediting should be avoided in normal operations as much as possible
- Determine if sourcing processes can benefit from using auctions, reverse auctions, exchanges, or portals.

Supplier selection, contracting, and use form the purchasing process. The purchasing process is itself part of the larger sourcing process that involves determining what to source and so on. In the purchasing process, specific suppliers are evaluated, negotiated with, selected, and contracted with. Ensuring proper contract deployment and management is critical to ongoing supplier effectiveness.

Contracts are an important factor in the success of customer and supplier relationships, so we'll also examine contract types, terms and conditions, payment terms and methods, and currency issues.

Finally, the operational side of purchasing is discussed: creating purchase orders, tracking open order status, reconciling and approving invoices, and expediting as needed.

Topic 1: Supplier Evaluation and Selection

Here we address the first few steps in the purchasing process, which occurs after the more strategic decisions related to sourcing have been made. We get down to the details of supplier selection criteria, including supplier value-added services, negotiation with suppliers, and contract deployment and management.

Purchasing Road Map

Exhibit 3-14 shows how supplier selection is the first step in the purchasing function. This step includes evaluations such as developing selection criteria or specifying necessary value-added services. Negotiation and its end result, contracting, are also discussed in this general content area.

Exhibit 3-14: Functions of Purchasing

Once an organization knows what it plans to do itself (its core competencies) and what it plans to use suppliers for and the level of relationship it desires for each supply need, it engages in the supplier selection process. Supplier searches can use auctions, reverse auctions, portals, exchanges, approved vendor lists, referrals or prior relationships, location-specific consulting organizations, competitive bidding using requests for quotation (RFQs) or invitations to tender (ITTs), or direct negotiation.

Optimizing the supply chain may require taking a nontraditional approach to selecting suppliers. Traditional thinking emphasizes making the greatest possible profit for the enterprise without regard to the impact on other parties. Suppliers look for the price that will yield the highest margin for them without regard to customer needs; buyers look for the lowest price without regard to the impact on the suppliers. Contracts may cover only short-term transactional arrangements.

Supply chain thinking requires a strategic view of sourcing that focuses on the long-term success of all partners along the supply chain. Pricing, discounts, delivery timing, and related matters can be established cooperatively, taking into account the needs of supplier and buyer. The emphasis is on establishing ongoing relationships rather than simply making a series of transactions, pitting suppliers against one another to drive down prices. The pressures in contemporary markets, from both customers and suppliers, necessitate forming deeper relationships for many sourcing solutions. Deeper relationships contribute to the profitability of an integrated supply chain as well as that of each partner.

Selection Criteria

An organization will use a range of criteria in conducting a supplier search and may place more or less weight on particular criteria to emphasize strategic priorities for the given category of supplier. Possible

criteria include strategic supply plans, technical specifications, desired quality, and supplier financial strength. Here we'll look at four other factors that can be used as selection criteria: costs, alignment with supply chain needs, adherence to corporate social responsibility policies, and ability to provide required value-added services.

Costs

To remain competitive, organizations must develop supplier relationships that allow them to lower total costs and, consequently, increase profits. Businesses must be able to source products and services and operate at the lowest costs possible, and they must partner with efficient and effective suppliers who can deliver goods and services on time and to specifications, especially when using lean or Just-in-Time production methods.

Two cost categories that can be used as selection criteria are total cost of ownership and cost of goods sold.

Total Cost of Ownership

Total cost of ownership (TCO) is discussed in detail elsewhere. A problem with TCO in a situation involving outsourcing is that too often companies look at the obvious—purchase price, transportation costs, duty costs associated with doing business on a letter of credit, etc.—but ignore the additional lead time. Longer lead times typically involve more inventory in the supply chain, and the carrying cost of that additional inventory needs to be included in the TCO analysis.

Let's look at an example. A company's initial analysis of copper tubing costs for Brazilian, Korean, Chinese, and U.S. suppliers showed that the supplier from China had the lowest costs, even after all landed costs were considered. However, when the inventory carrying costs due to the longer lead times were included, the U.S. supplier, located only three hours away, actually had the lowest costs. This example is illustrated in .

Exhibit 3-15: TCO Comparative Example

CPC # PO332932 Description: 3/8″ Copper Tubing Type M, 10′ long

Suppliers	**A (Brazil)**	**B (Korea)**	**C (China)**	**D (U.S.A)**
Landed costs				
Price per unit	USD 9.800	USD 9.600	USD 8.200	USD 11.200
Inbound transportation	1.200	1.600	1.650	0.211
Total landed costs	11.000	11.200	9.85	11.411
Life-cycle costs				
Contracting	0.200	0.200	0.200	0.200
Business unit purchasing	1.488	0.880	0.990	0.790
Logistics administration	2.120	2.570	2.100	1.110
Receiving	0.027	0.032	0.054	0.012
Inspection	0.050	0.070	0.110	0.080
Cost of internal quality	0.430	0.540	0.520	0.780
Inventory carrying	1.200	1.600	1.650	0.08
Accounts payable	0.050	0.050	0.050	0.050
Exchange rate factor	0.057	2.000	0.003	0.000
Outbound transportation	0.100	0.100	0.100	0.100
Waste disposal	0.054	0.054	0.054	0.054
Cost of external quality	0.068	0.064	0.062	0.080
Total LCC	5.844	8.160	5.893	3.336
TCO (Landed + LCC)	USD 16.844	USD 19.360	USD 15.743	USD 14.747

Cost of Goods Sold

Lowering the total cost of goods sold (COGS) is of strategic importance to a company. Such costs exert a strong amount of leverage over profits. A dollar decrease in COGS will be reflected as a dollar increase in gross margin. A dollar increase of sales has to be offset by COGS, and only the net will be added to the gross margin. Therefore, reducing the costs of materials, labor, or overhead through efficient supply management is more effective. This point is illustrated in the scenario shown in .

Exhibit 3-16: COGS Example

Assume the following:

- Product price is $1.00.
- Total COGS is $.95/unit = $.60/unit (material) + $.25/unit (labor) + $.10 (overhead).

(Note: All amounts are in U.S. dollars.)

Scenario:
Assume sale of 1,000 units.

Revenue			$1,000.00
Material	$600.00		
Labor	$250.00		
Overhead	$100.00		
COGS			$950.00
Gross margin			$50.00
GM %			5.00%

Situation 1:
Let's reduce the material cost by 5%. The cost of material is now $.57/unit. That's a $30 reduction in COGS for the 1,000 units, which goes right to the GM (gross margin) of $80 or 8%.

Revenue			$1,000.00
Material	$570.00		
Labor	$250.00		
Overhead	$100.00		
COGS			$920.00
Gross margin			$80.00
GM %			8.00%

GM % has increased by 60%. The $30 went right to profit.

Situation 2:
Now, let's build off the original scenario again and instead increase sales by $30. Revenue goes up by $30 by selling 30 more units. But GM goes up only by $1.50, because even though 30 more units were sold, we still spent $.95 for each unit in COGS.

Revenue			$1,030.00
Material	$618.00		
Labor	$257.50		
Overhead	$103.00		
COGS			$978.50
Gross margin			$51.50
GM %			5.00%

GM % is flat.

Situation 3:
This last situation shows how many units would have to be sold to match the GM dollar amount from the reduced materials cost (Situation 1). As you can see, an additional 600 units would need to be sold.

Revenue			$1,600.00
Material	$960.00		
Labor	$400.00		
Overhead	$160.00		
COGS			$1,520.00
Gross margin			$80.00
GM %			5.00%

Alignment with Supply Chain Needs

Oftentimes, the focus on cost reduction leads to global sourcing and procurement. But in order for an organization to have a successful offshore partnership, the potential suppliers must have business processes and efficiencies that complement the strategic goals of the organization's supply chain, and they must be able to deliver on their capabilities to provide value for the customer. Successful offshore partnering does not happen by chance. Before entering into a strategic global alliance, both organizations need to lay the appropriate groundwork.

Site visits should be considered a requirement before establishing onshore or offshore partnerships. All key stakeholders who will be involved in the relationship should participate, and critical processes and technology should be reviewed for the ease of interfacing (i.e., cost and time required for interfaces).

Another supply chain factor to consider is the supplier's technical communications ability so that the supplier can receive real-time information on customer orders and thus reduce supply chain problems such as the bullwhip effect.

Corporate Social Responsibility Policy

Since the organization that owns a product brand and image will be held responsible for the activities of its extended supply chain, most organizations consider how potential partners could affect their reputation. Prior to searching for suppliers, persons responsible for supplier selection should consult an organization's corporate social responsibility (CSR) policy for guidance.

The CSR policy, also called the corporate citizenship policy, is a type of organizational self-regulation that involves adding priorities to an organization's business model. The model still focuses on profits but also defines success as meeting the needs of the community and the environment.

The CSR policy requires that employees and suppliers hold themselves accountable for compliance, but the organization may need to audit prospective suppliers and monitor existing suppliers for compliance.

Topics of a CSR policy related to supplier selection could include

- Customer health and safety (e.g., supplier's product and service safety relating to legal liability, such as being nontoxic or defect-free)
- Employee health and safety (e.g., risk exposure of employees of supplier)
- Environmental sustainability (e.g., supplier's energy use, carbon footprint, use of recycled or reused materials)
- Maintainability (e.g., total cost of ownership of supplier's products)
- Employment policy (e.g., supplier's wages relative to regional averages, abstaining from exploitation such as child labor)
- Community reinvestment and use of local goods and services (e.g., requiring local supplier search, including transportation cost savings in selection criteria, or ranking local suppliers higher in evaluations).

The CSR policy is often based in part upon compliance with international or home-country laws and regulations. Legal review will determine the extent to which such laws or regulations have jurisdiction over supplier methods or products.

Product design will also play a role in supplier selection and CSR. Products designed to minimize the need for hazardous materials are an example.

Supplier Value-Added Services

A general category of supplier value-added services that many organizations have come to expect can be summarized as world-class service. As organizations look to right-size their supply base, any new suppliers that are added will need to be as good as or better than existing suppliers in the given category. This could entail excellent on-time delivery performance, ability to meet service level agreements, and ability to collaborate on designs or ongoing cost improvements. Examples of supplier value-added services include

- Management of inventory at the buyer's site
- Maintaining safety stocks of components so the organization doesn't have to
- Quick responses to changing product or volume requirements (e.g., reconfigurable manufacturing equipment)
- Adopting compatible transfer packaging to eliminate customer process steps (e.g., a product shipped in reels to enable direct loading to a machine) or to be reusable
- Break-bulking or consolidation of goods from various sources (upstream warehouses)
- Consulting services, such as input to category market research or evaluating various materials or production methods for potential use
- E-purchasing and e-commerce capabilities
- Technology capabilities, ranging from computer-aided design (CAD), to track and trace (e.g., RFID and GPS), to full network integration, plus good cybersecurity
- Long-term relationship potential, such as a culture that embraces change or a willingness to invest funds in the relationship, share data, or share costs and profits.

Negotiation

Negotiation is an important part of contract development. The *APICS Dictionary,* 16th edition, defines **negotiation** as "the process by which a buyer and a supplier agree upon the conditions surrounding the purchase of an item or a service." Negotiation for commodities will differ greatly from negotiation for outsourced functions that have great impact on the supply chain.

Typical areas that require negotiation include technical specifications, prices, purchase volumes, delivery lead time, other delivery terms, and many other terms and conditions.

Types of Negotiation

Two types of negotiation are competitive bidding and direct negotiation. Competitive bidding for commodities may take the form of online auctions or reverse auctions that are based entirely on price. Even automated purchasing is possible. Competitive bidding can take the form of a formal request for quotation (RFQ) or invitation to tender (ITT) process. These processes set a prerequisite of the supplier being technically qualified to make a bid. Buyers need to be able to provide clear specifications to sellers and give enough time for detailed responses, a round of queries (any responses are provided to all bidders), demonstrations, visits, and so on. The final steps in this process may involve a limited amount of direct negotiation with a short list of suppliers who meet the selection criteria, or the organization could simply select a supplier based on best overall weighted value. After the winning bidder accepts, other bidders are informed.

Internet-enabled sourcing provides a much larger number of sources located across the globe to be evaluated in a shorter span of time than traditional methods. Internet-enabled sourcing is available as a feature of purchased or SaaS (software as a service) supplier relationship management (SRM)

software or through enterprise resources planning (ERP) systems. SaaS vendors can host online bidding events while the organization's senior purchasing managers observe the action and make final decisions. Internet-enabled sourcing can use trading exchanges to find suppliers. Negotiation automation tools include online RFQ or ITT submission and response gathering. An RFQ or ITT can be encoded so that the marketplace lists only qualifying vendors. Product searches can use multiple vendor online catalogs.

Direct negotiation may be needed if the RFQ/ITT process would be cumbersome or there is only one supplier being considered. It may be more expensive than competitive bidding because the process often requires more direct interaction. Direct negotiation is often needed instead of competitive bidding for

- Materials that have hard-to-define costs, numerous risks, or high complexity
- Materials with preferred suppliers (if no other suppliers are being considered)
- Bottleneck materials (The presence of few providers in the marketplace makes the use of RFQs/ITTs difficult.)
- Core-competency materials and/or relationships that require strategic partnerships or collaborations such as on product design.

Negotiation Principles and Tactics

While the level of importance of the relationship will dictate the amount of time and energy spent on negotiation, all negotiation can benefit from sound negotiating principles. This is especially the case when working to transform an organization from traditional adversarial relationships with suppliers to more constructive partnerships.

Traditional negotiating tactics include the following forms, which are called position-based tactics:

- Hard negotiators view other parties as adversaries to be beaten, so they take a position, demand concessions, and give none in return. They threaten, mislead, or pressure the other party. This can endanger long-term success.
- Soft negotiators value agreement to the point that they disclose their bottom line, alter their position, or accept one-sided agreements that involve only concessions. Contracts may be won, but this party is left feeling exploited and may be financially at risk.

These positions can be described as win/lose or lose/win.

Fisher and Ury of the Harvard Negotiation Project developed a third option: a win/win negotiation technique called principled negotiation. Rather than negotiation in which each party sequentially takes and gives up actual or deceitful positions, principled negotiation starts by insisting on several criteria for long-term gain (none of which are typically present in win/lose or lose/win tactics):

- Negotiation should efficiently solve the underlying issues.
- Negotiation should preserve or increase positive relationships.

- Agreements, if reached, should endure, meet both parties' actual needs to the extent possible, resolve conflicts of interest fairly, and be in the community's interests.

Principled negotiation is a four-step interest-based bargaining style:

1. **Separate the people from the problem.** Rather than trying to be adversaries or friends, principled negotiators insist on the criteria listed above for long-term gain. They attack the problem rather than the other party.
2. **Focus on interests, not positions.** Position taking leads to defensiveness. Principled negotiation avoids taking positions or a bottom line at all. Instead, negotiators relate what they are interested in achieving and seek to understand what the other party is interested in achieving.
3. **Invent options for mutual gain.** Principled negotiators first seek a time frame in which to study the problem rather than bowing to time-based pressure. During this time they devise alternatives that could satisfy the interests of both parties.
4. **Insist on the use of objective criteria.** Rather than engaging in haggling, principled negotiators guide any disagreement toward deciding upon a fair standard that both parties can agree will be the basis for the decision (e.g., market value, expert opinion, analysis results, the law, ethical standards).

Principled negotiation or similar negotiation tactics can result in relationships that are perceived as profitable and indispensable by both parties, which, in turn, means that the buyer is not constantly looking for a new supplier or vice versa.

Another negotiation tool, called triangle talk, is discussed by Monczka, et al., in *Purchasing and Supply Chain Management,* which cites a book by K. Anderson for this method. Basically, negotiation forms a triangle. One point of the triangle is knowing exactly what you want; this is the first step. The second point of the triangle is knowing exactly what the other party wants; this is the second step. It requires making the other party feel heard. The third triangle point and step is proposing a solution in a way that the other party can accept. This method involves separating wants from needs—in other words, separating definite deal breakers from things a negotiator would like to have. Working to sort out your and the other party's needs from wants is the key to success in this method.

These and other methods share one important negotiation preparation step. Both parties in a negotiation are advised to predetermine their best alternative to a negotiated agreement. This is what the organization would do if the negotiation fails. It might be to manufacture the product in house, partner with an existing supplier to expand their operations, and so on. When the costs and benefits of this alternative are known in advance, the negotiator will know when it is better to walk away (or to take an offer that still beats this best alternative).

Contract Deployment and Management

Once a contract has been signed, the contract deployment process is used to get the agreement to function as intended. Organizations regularly monitor relationships for responsiveness, on-time delivery,

order accuracy, product or service quality, and invoicing and payment accuracy. They also informally maintain relationships to anticipate and avoid problems and to develop cooperation and trust.

Deployment

The main purpose of contract deployment is to ensure a smooth transition to new partners and successful adoption across the organization. Without diligence in rolling out contracts and continuous monitoring of both internal adoption and performance, contract deployment ultimately will fail to deliver the anticipated economic and other benefits. Because an organization may continually be adding, removing, and replacing partners over time, contract deployment is an ongoing function.

Contract deployment activities include

- Navigating the legal maze involved in creating a new agreement
- Communicating with the winning supplier
- Promoting the benefits of new agreements to internal buyers
- Loading new contracts into a centralized contract management database
- Implementing order-to-payment procedures
- Training users and suppliers on new procedures
- Validating performance against measures and key performance indicators
- Integrating and deploying transaction management systems
- Auditing initial invoices for accuracy and compliance.

Compliance Management

Compliance management, which is emerging as a discipline equal in importance to strategic sourcing, consists of

- Defining and implementing strategies to concentrate purchases with preferred suppliers
- Monitoring and measuring compliance and identifying off-contract purchases to uncover lost savings opportunities
- Channeling findings to management for remediation
- Monitoring and reporting on key performance metrics
- Auditing pricing to ensure accurate billing
- Monitoring contract expirations, executing renewals, ensuring proper rebates and early payment discounts
- Driving continuous process and incremental cost improvements
- Establishing baselines for new sourcing initiatives.

Technology makes it possible to merge data from various sources and make them quickly visible to senior management for analysis and action.

Measuring Success and Avoiding Pitfalls

Unsatisfactory performance is a great risk. It can cause an otherwise sound business strategy to fail. To avoid this pitfall, organizations should follow some basic guidelines.

- **Establish clear performance expectations.** Clear performance expectations must be addressed up front. For example, a performance indicator may be the volume of customer complaints. Rather than using anecdotal information about complaints, best practices involve a complaint tracking system with monthly reports and specific performance improvement targets. Another best practice is a formal **service level agreement (SLA) ,** which is “a document that represents the terms of performance for organic support” (*APICS Dictionary,* 16th edition) that is updated each year.

- **Measure against those performance expectations at regular intervals.** It is imperative for organizations to monitor performance proactively. Continuous monitoring programs measure performance against predetermined metrics and adjust them as changes in customers’ needs occur. Ensuring that suppliers have adequate internal controls is essential; these controls are needed to capture accurate billing data as well as provide critical information on how suppliers manage their business and process risks. Consider, for example, an organization that outsources telemarketing services to a supplier. One month, the supplier’s invoice indicates an overbilling of several hundred thousand dollars; however, they cannot provide evidence for the overbilling due to poor internal controls and record keeping. Organizations should consider instituting a policy of reviewing potential suppliers’ internal controls *before* entering into a contract.

- **Maintain ultimate responsibility.** Many organizations have the false idea that once they contract for an activity, they no longer need to be involved. Although the supplier may be fully capable of handling an activity, the organization should not relinquish the complete management of the relationship. For example, if day-to-day customer care activities are outsourced, the organization should still maintain a close watch over customers’ needs and expectations and monitor the supplier’s overall effectiveness. This fact highlights the increased demand for risk sharing. Partnerships with equal sharing of risk have become a key method for managing new product development and controlling rising operations costs.

- **Coordinate the activities of multiple suppliers and share experience and knowledge.** It is essential for organizations working with multiple suppliers to establish formal sharing of best practices.

- **Maintain an exit strategy.** When the need for a new outsourced supplier arises, organizations need to be prepared with a formal backup plan for each key supplier. Although the need for consolidation is important, a best practice is to spread vital activities among multiple suppliers if feasible. This reduces the operational disruptions that come with switching suppliers.

Topic 2: Contracts

After defining contracts and related terms, here we describe various contract types as well as a number of common terms and conditions. Other contract considerations discussed here include payment terms, the use of letters of credit for financing, and foreign currency.

Contract Types and Details

Sales agreements or contracts are an important part of any business relationship. The *APICS Dictionary,* 16th edition, defines a **contract** as

> an agreement between two or more competent persons or companies to perform or not to perform specific acts or services or to deliver merchandise. A contract may be oral or written. A purchase order, when accepted by a supplier, operates as the highest level of a contract except where a longer-term contract exists. Acceptance may be in writing or by performance, unless the purchase order requires acceptance in writing.

Other contract-related terms defined in the *Dictionary* include the following:

> **Annualized contract :** A negotiated agreement with a supplier for one year that sets pricing, helps ensure a continuous supply of material, and provides the supplier with estimated future requirements.
>
> **Bilateral contract :** An agreement wherein each party makes a promise to the other party.
>
> **Contracts for the international sale of goods (CISG) :** Governs the sale of goods in the international environment. They enable exporters to avoid choice-of-law issues.
>
> **Trading partner agreement :** A contract between trading partners that describes all facets of their business together. This is a legal and binding agreement suitable for legal purposes as well as standard working agreements.

The level of relationship will dictate the type of contract that is needed. When buying on the market, a purchase order constitutes the highest level of contract that will generally exist. Ongoing relationships can use an annualized contract, while partnerships or collaborations/strategic alliances will form a long-term trading partner agreement, which is a type of bilateral contract.

Contract Types

Contracts take a few basic forms that need to be differentiated because they strongly affect which party accepts more of the risks if there are cost or schedule overruns.

The *Dictionary* defines various contract types as follows:

> **Cost-based contract :** A type of purchasing contract where the price of goods or services is tied to the cost of key inputs or other economic factors, such as interest rates.

Cost-plus contract : A pricing method where the buyer agrees to pay the seller all the acceptable costs of the product or service up to a maximum cost plus a fixed fee.

Cost-plus-fixed-fee contract : A contract in which the seller is paid for costs specified as allowable in the contract plus a stipulated fixed fee.

Cost-plus-incentive-fee contract : A contract in which the seller is paid for costs specified as allowable in the contract plus a profit provided certain provisions are met.

Firm fixed-price contract : A contract in which the seller is paid a set price without regard to costs.

A pure cost-based contract minimizes the risk for the supplier because cost overruns are charged to the customer. These types of contracts might be appropriate when it is impossible for either party to accurately assess costs in advance and there is a level of trust between partners. Such contracts need to be audited regularly to ensure that all costs charged are reasonable and appropriate.

Firm fixed-price contracts minimize the risk for the customer because the supplier must absorb all cost overruns. These contracts are appropriate for products and services that have a market value that is easy to determine or costs are otherwise reliably estimated.

Incentive arrangements and contracts, which provide incentives for desired behavior, can help specifically with customer relationship management and supplier relationship management initiatives or other similar collaborative arrangements between organizations. The *Dictionary* defines incentive contracts as follows:

Incentive contract : A contract where the buyer and seller agree to a target cost and maximum price. Cost savings below the target are shared between buyer and seller. If actual cost exceeds the target cost, the cost overrun is shared between buyer and seller up to the maximum price.

Incentive arrangements : The incentive contract allows for the sharing of the cost responsibility between the buyer and seller. Incentives are incorporated into the contracts to motivate the supplier to improve its performance in areas such as quality, on-time delivery, and customer satisfaction. There are three elements of an incentive agreement: target cost, target profit, and the sharing agreement.

Fixed-price-incentive-fee contract : A contract in which the seller is paid a set price and can earn an additional profit if certain stipulations are met.

Incentive arrangements and contracts can be part of an overall trading partner agreement or can be negotiated separately. The benefit of such arrangements is that they align collaborative goals with individual motivations. The motivations are the cause that generates the effect of collaboration. Traditional self-centered motivations cannot be expected to generate anything other than self-centered effects.

As stated in the definition of incentive arrangements, the organizations must settle on a desired cost and a profit margin for goods or services. These targets should be challenging but realistic. Both parties will be motivated to find ways to cut costs due to the mutual increase in profitability. The targets can be increased over time as goals are met. The organizations must also determine how the profits or excess costs will be split among the partners and to what maximum price any cost overruns will be shared among the partners.

Contract Terms and Conditions

If a relationship is to be successful, both parties must know and understand their responsibilities. Normal responsibilities must be defined in the form of terms and conditions. The *Dictionary* defines **terms and conditions** as “all the provisions and agreements of a contract.”

These contract clauses should specify what actions can be taken by each party if unexpected events arise or failures occur. They are both the rules of fair play between the parties and the method of encouraging fulfillment of strategic goals.

It is important not to accept another party’s assurances that an undesirable contract clause is simply standard “boilerplate” legalese that won’t be an issue. If negotiations cannot arrive at a fair set of contract details, it is better to walk away.

Also, no contract should ever be signed without first being reviewed by your legal representatives, specifically those who have experience with contract law.

The following are some of the common contract terms and conditions that should be clearly spelled out in writing. Hypothetical examples are provided to illustrate the contract concepts. (Note: These examples are not intended to provide actual contract language, which should always be created with the assistance of legal counsel.)

- **Pricing.** Accepted price quotes may include more than just price per unit. For example, packaging estimates may be included. Some contracts set fixed prices with certain price increases allowed based on certain contingencies, such as increases in raw materials (called escalation), while other pricing contracts may specify that orders use current market prices.

  > **Example:** The unit pricing for the product is set forth in Schedule B. Prices for spare parts, accessories, and packaging are set forth in Schedule C. The supplier may increase pricing in Schedules B and C once every 12 months during the term of the agreement, not to exceed 4 percent and provided that the supplier provides 3 months’ written notice prior to any such increase.

- **Delivery requirements.** This should specify dates, locations, and conditions such as how orders will be placed, how a product is to be protected during shipment, what modes of shipping are to be used, minimum or maximum orders, and the like.

> **Example:** The supplier will deliver the products in accordance with the delivery schedules. If the supplier fails to deliver the products in accordance with the schedule, the supplier will provide written notice to the purchaser stating the reason(s) and planned resolution.

- **Transfer of ownership (Incoterms® trade terms).** Incoterms® trade terms stated in the contract will affect when each party is responsible for the freight. This is required only for international transactions, although companies may elect to use the terms for domestic freight as well.

- **Payment terms.** These terms should address not only timing and form of payment but special issues such as currency exchange. To manage risk, it may be possible to stipulate the exchange rate to be used in the contract with the supplier or a period of time during which a sampling of exchange rates will be used as a basis for currency exchange.

  > **Example:** The purchaser agrees to pay the supplier's invoices within 30 days of receipt. Invoices shall be paid in Hong Kong dollars (HKD).

- **Performance criteria.** How will performance requirements be met? For example, specifications of product or service attributes should be noted along with which attributes are more important and why.

  > **Example:** The supplier agrees to manufacture the product under ISO standards X and Y. The supplier will maintain the documentation necessary to prove compliance to ISO standards X and Y.

- **Quality assurance.** The management process and performance standards the organization has in place in order to assure quality, including any specific standards with which the supplier must be compliant or registered, should be specified.

  > **Example:** The supplier agrees to the purchaser's quality audits of the manufacturing facility at the purchaser's request and subject to scheduling approval.

- **Order requirements.** This includes measurements of standard deliveries, quantities that a company wants, and the date on which the order is due. The contract may state the company order period (i.e., 60 days), which is the time between when a purchase order is placed and goods are available per the Incoterms® trade terms. Purchase orders are also considered contracts with stated quantities and pricing confirmed by each party.

  > **Example:** Deliverables and dates are as specified. Three days early or late is considered acceptable on-time delivery and used for supplier evaluation purposes.

- **Associated incentives and penalties.** The contract should detail how an organization will provide business assistance and/or incentives to a supplier or help them to improve. Incentives may include contractual sharing of cost savings. Any penalties to be assessed when problems occur need to be communicated as well.

  > **Example:** Failure to deliver the product in accordance with delivery schedules and failure to resolve the issue within 30 days will give the purchaser the option to terminate the agreement, with written notice to the supplier.

- **Status reporting.** A successful partnership depends on good communication. Both parties must establish trust and confidence with each other so that an open exchange of information occurs. The contract should cover provisions for routine communication in terms of frequency and types (e.g., face-to-face meetings, online conferencing, electronic reports, hubs or dedicated workstations, intranet sites, blogs).

  > **Example:** The purchaser will establish an internet-enabled portal where employees and partners can post daily communication entries and notes to support collaborative planning, forecasting, and replenishment. Regular meetings will be held to review open orders, engineering changes, design issues, production issues, etc.

- **Channels for resolving problems.** In the event of quality or delivery problems, what are the expectations and protocol for corrective actions to enable a swift resolution and prevent a recurrence? If task conflicts arise from disagreements in viewpoints or ideas, what conflict resolution technique will be used that is culturally and contextually appropriate?

  > **Example:** Following fact finding and the opportunity for both parties to discuss a point of contention, alternate dispute resolution, including a third-party arbiter, shall be used to resolve conflicts. This third party shall be mutually agreed upon before contract signing.

- **Security requirements.** What are the safeguards that must be in place to prevent unauthorized access to proprietary data? Are there data that need to be classified? Are there specific requirements for sharing data? Are there security issues for the goods in transit that need to be addressed to meet the customs compliance requirements of specific countries? This contract element involves measures to mitigate security risks for both parties.

  > **Example:** Neither party shall disclose confidential information that has been disclosed to it by the other party to any other third party, without the prior written consent of the disclosing party. Freight forwarders and transportation providers must be C-TPAT-certified.

- **Language of the contract.** Will a contract written in English be acceptable to all parties? Are there are language differences that necessitate translation? Correct translation is critical. It is also beneficial to define all vague wording (multiple meanings) and acronyms. Depending on how many of these terms exist, a separate section may be warranted.

  > **Example:** The initial contract will be written in English. The document will be translated by the organization's translator and submitted to the supplier for review. The translator will address any translation questions from the supplier. It should be noted that the term "business day" means a day other than a Saturday or Sunday on which banks are open for business in New York and Luxembourg City.

- **Contract termination.** The process and terms for contract termination (e.g., when and how, advance notice requirements) should be defined.

  > **Example:** This agreement may be terminated by the purchaser for any reason with 6 months' prior notice to the supplier.

- **Legal authority.** In global sourcing, an organization's relationship with a supplier may be influenced by many layers of laws, regulations, directives, and international treaties. Requirements of particular countries should be specified.

  > **Example:** The validity of this agreement and any amendments shall be governed by the law of the Czech Republic with the intention that the rules of the United Nations Convention on International Sale of Goods shall not apply with the application of any conflict of principles.

Contract Payment Considerations

Contracts need to specify payment terms in ways that address each party's risk appropriately and provide incentives for desired payment timing. One type of payment method, a letter of credit, is discussed, since this is a common method for international transactions. Also discussed here are how to address contracts that use foreign currencies.

Payment Terms

In any trade or financial transaction, there is a risk that the other party (the counterparty) will fail to honor the terms of the agreement. This is called counterparty risk. The seller always runs the risk that the buyer won't pay on time or won't pay at all or will pay but in counterfeit currency, just as the buyer risks taking delivery of inferior goods or no goods at all.

Organizations need to specify payment terms in contracts with suppliers or customers. The *APICS Dictionary,* 16th edition, defines **payment terms** as "conditions surrounding payment for a sale, providing a time frame in which a customer can pay without late penalties or additional fees." These

terms specify when payment is due, whether shipment will occur before or after payment is made, and the method of payment that is required.

Very few transactions, domestically or cross-border, are financed by payment in advance or cash on delivery (COD)—although both do occur, generally if the parties are closely related, as in the case of subsidiaries or if one party is well established and the other unknown. For example, a well-established industrial HVAC supplier requires all sales be paid in full by wire transfer prior to arranging a shipment. However, for established mutual relationships, trade credit or an open account is often extended, which is essentially an unsecured, trust-based transaction between the parties.

Trade credit is the sale of goods or services in which payment is not due right away. Trade credit encourages sales because it is effectively offering free financing over the payment period. The buyer has time to convert the good or service into revenue before making payment. With an open account, a buyer has a credit limit with the organization or a bank and can place orders or write drafts up to the limit to pay for goods or services on receipt or on a deferred basis. When an open account is with the organization, it is synonymous with trade credit. Trade credit and open accounts are offered only to trading partners with good credit records and healthy financials (e.g., financial ratios and reports) because of the possibility of default.

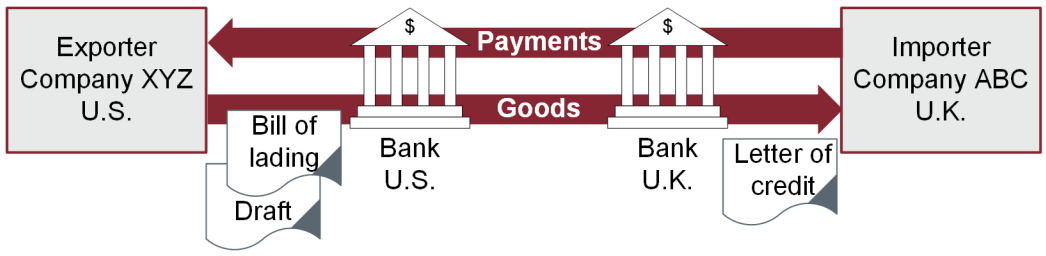
In addition to providing a deadline for payment without penalties, many organizations offer a discount to encourage early payment. For example, payment terms of 1/10 net 30 mean that the buying organization will receive a 1 percent discount if payment is made within 10 days but has up to 30 days to make the full (net) payment with no late penalties. An organization’s accounts payable or treasury personnel can calculate whether taking a discount is worth more or less than the ability to wait longer to make the payment. Similarly, the invoicing organization’s finance professionals will craft any discount to make financial sense for the organization: nearly equivalent either way, with a small tip in the direction they want the buyer to choose.

Documentation for domestic business-to-business customers usually includes an invoice and a bill of lading (B/L). Invoicing internationally has far greater documentation requirements, in addition to requiring that payment be made in some secure manner such as a letter of credit.

Letters of Credit

Since trade credit or an open account may not offer the risk protection that either party desires in an international transaction, organizations need a more sophisticated form of payment, and in many import-export transactions this takes the form of a letter of credit (L/C). The letter of credit (illustrated in Exhibit 3-17) offers security from counterparty risk in a tidy, but complicated, package.

Exhibit 3-17: Letter of Credit



A letter of credit is just what its name implies: a letter in which a bank assures the seller that the buyer can pay the purchase price of the goods and that the bank will therefore honor the buyer's checks to the seller up to that amount. The bank makes this assurance either because it has reason to believe that the buyer's credit is good or because the buyer has an account with the bank.

The sequence of events goes something like the following. (Note that the use of two banks instead of just one in this example makes this an example of a confirmed L/C; when just one bank is used, it is an unconfirmed L/C, which has a little more risk.)

- **L/C is issued.** After agreeing to the terms of sale, the buyer/importer goes to its bank and gets a letter of credit demonstrating that the bank has faith in the buyer/importer's ability to pay the purchase price.

- **Seller's bank is notified.** The buyer's bank notifies the seller's bank that the L/C has been issued. This assures the seller's bank that it can honor drafts from the seller up to the amount of the purchase price as long as the bank receives the proper documentation.

- **Seller ships cargo.** Confident of receiving payment when the goods have arrived as specified, the seller has the cargo shipped. The carrier sends a B/L (or waybill for air carriage) to the seller's bank.

- **Seller asks its banker for money.** After shipping the cargo, the seller sends a draft for the purchase price to its banker, who now has the seller's draft plus the carrier's B/L.

- **Seller's bank asks buyer's banker for money.** The seller's bank forwards the documents to the buyer's bank. The B/L from the carrier usually assigns ownership of the goods to the buyer's bank, not directly to the buyer. This provides the bank with some security since it can wait to release the ownership documents to the buyer until it is sure of being repaid.

- **Buyer's bank waits for cargo (perhaps).** When the buyer's bank receives a draft and B/L (or waybill) from the seller's bank, the cargo may still be en route (if it has been shipped by marine carrier). Therefore the drafts may be payable at some future date rather than immediately. Payment may or may not depend upon the buyer's officially taking delivery of the cargo.

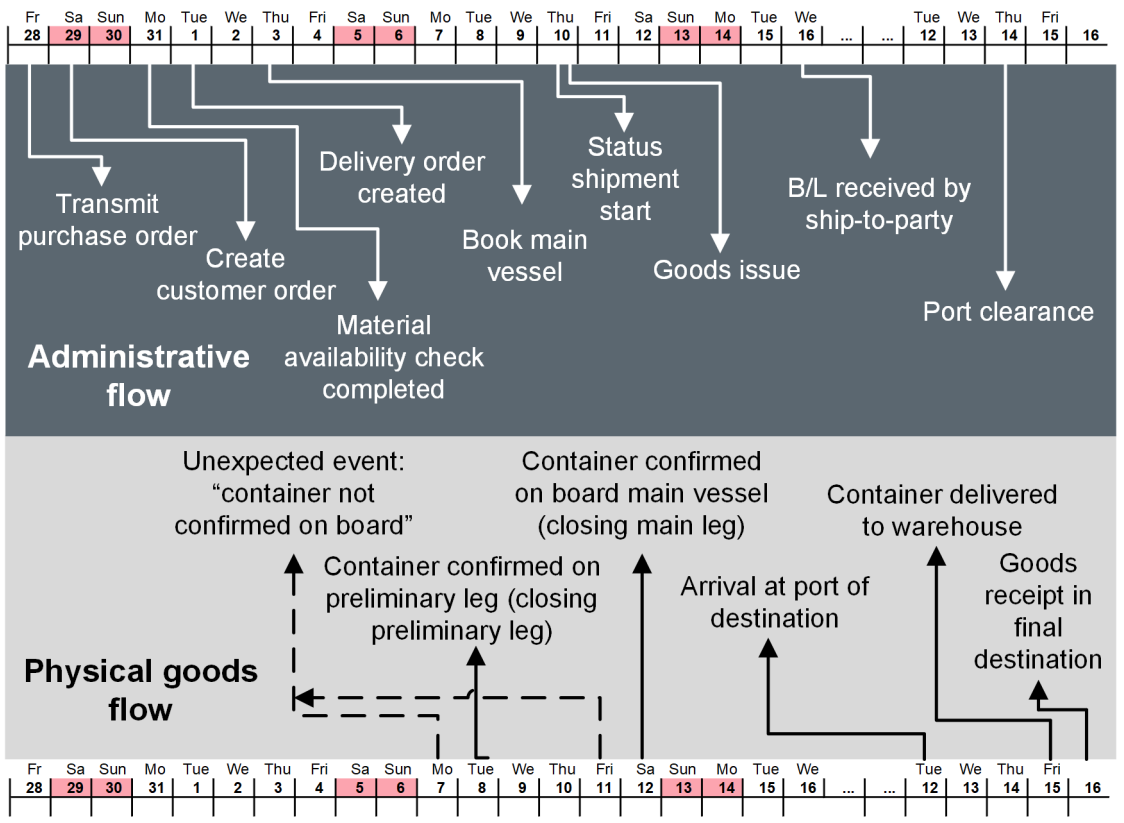
- **Everyone gets paid.** At the time specified—say, when the buyer approves the cargo and accepts delivery—all outstanding drafts are honored. The buyer pays its banker; its banker pays the seller's banker; the seller's banker pays the seller. The order may not be quite so neat; this is a credit

transaction, after all, and some level of trust may be involved. The deal can break down at this point. For example, an unethical buyer might refuse to accept delivery and leave the cargo sitting on the wharf while attempting to negotiate a better price with the seller, who cannot afford to ship the goods back home. In some cases, payment is due before the buyer takes possession. (The contract can specify a grace period.) If the goods turn out to be damaged, substandard, or otherwise unacceptable, the buyer may reject the shipment and is at risk of not getting a refund and having to write the whole deal off on its taxes.

Although the L/C is the standard method of financing international trade, other methods are used on occasion, such as trade credit or an open account. In addition, a buyer might pay in advance, taking on the greatest amount of risk. And in a consignment transaction, goods are shipped for resale—say, from one division of a company to another division in a foreign country.

Exhibit 3-18 provides a real-world example of tracking both the physical flow of exported goods and the physical or electronic document trail that accompanies the goods from purchase order on the left to receipt at the final destination on the right. Note the “unexpected events” at the bottom. It’s not always smooth sailing in global trade.

Exhibit 3-18: Export Processes—Administrative and Physical



Source: BASF

Currency Issues

Just as cargo can sometimes be tripped up at a border crossing, so can payments have their difficulties getting from one country to the next. (As can information, for that matter.) In multicurrency situations, the buyer and the seller both may experience currency exchange risk—a risk caused by the fluctuating rate of exchange between their two currencies. A buyer might make a commitment to pay the

equivalent of 200,000 euros to a Japanese seller (who, of course, wants yen, not euros) and actually wind up paying, say, 215,000 euros when trading the euro for yen to make the payment. If, on the other hand, the yen were to weaken against the euro, the buyer would get, in effect, a discounted price.

Impact of Currency Selection

Organizations have some leeway under accounting rules to select the primary currency with which they conduct the bulk of their transactions—called their home currency for accounting purposes—and this can minimize the total amount of foreign exchange that is needed. They can also maintain foreign currency bank accounts to buy and sell in the same currencies as their trading partners, thus avoiding the need for foreign exchange. Of course, the value of the funds in these accounts will fluctuate for accounting purposes, but such accounts do avoid foreign exchange fees. These tactics can work well for the major currencies of the world; organizations tend to avoid working with currencies that have less-established trading markets.

Currency exchange risk creates **operating exposure** for an organization, which the *Dictionary* defines as

> the risk introduced by flexible exchange rates when operating in the global environment, including production, storage, and buying and selling prices.

Thus currency exchange risk affects not only the effective prices for supplies and for sales to customers but also operating and storage costs and inventory value. The accounting value of one's inventory will fluctuate if it is produced and valued in the currency of a country that isn't the organization's home currency. In such cases, the value of the assets will be adjusted up or down for financial reporting purposes to account for the exchange rates between the countries. This can, in turn, positively or negatively impact the organization's financial ratios and thus its market value (e.g., stock price) and ability to access credit. The key problem with this type of risk is that it creates volatility while the organization's owners or lenders desire stability. Often they are willing to trade away the upside of a given currency fluctuation to also limit the downside. In other cases, they are willing to pay significant fees to limit this volatility. Methods to limit volatility are called hedging, and it is called currency hedging when applied to foreign currency transactions.

Currency Hedging

If you aren't dealing in the same currency as your counterparty in an import-export transaction, you have to find ways of making or collecting a payment with minimal risk. One technique is currency hedging, which is used to offset the risks associated with the changing value of currency. An array of financial products can be used toward this end, including forwards, futures, swaps, and options. The most common tool used in currency hedging is currency futures, in which one party agrees to buy/sell a fixed amount of a given currency at a fixed exchange rate on a fixed date in the future. Futures are

traded on organized exchanges or clearinghouses; these third parties reduce counterparty risk by serving as intermediaries to both buyer and seller.

Currency hedging is not always available, but it is readily found in the major currencies of the world economy. While most large corporations now have entire departments devoted solely to hedging and risk management, small companies often lack the resources necessary to engage in currency hedging. In this case, a broker/dealer organization can perform these services for a fee, Note that currency hedging can result in large losses if poorly managed, so the process needs experts as well as expert oversight.

Topic 3: Purchase Orders

Here we discuss the operational portions of the purchasing process: placing orders, reconciling invoices and approving them for payment, tracking the status of open orders (from an internal functional area perspective), and expediting supply or transportation.

After that, we address the various ways that ordering can be automated using e-procurement, including by using auctions, reverse auctions, exchanges, and portals.

Purchase Orders Road Map

The process of placing purchase orders is used for the bulk of an organization's purchases. Some items that are below a monetary threshold may alternately be purchased using a corporate credit card, while strategic or other more important investments may use other types of contracts.

The process starts with a purchase requisition, which needs to be approved. Once approved, a purchase order is created. This results in an open order in the organization's systems. Various types of purchase orders or e-procurement are discussed next. After the order is received and accepted, the invoice is reconciled and approved for payment, and this part of process is also discussed.

Placing Orders

All types of purchase orders or e-procurement constitute a legally binding contract. Two elements of a legally binding contract are contractual offer and contractual acceptance. The first occurs when a purchase order is transmitted; the second occurs when the supplier acknowledges the purchase order.

Purchase Orders

The *APICS Dictionary,* 16th edition, defines a **purchase order** as follows.

> The purchaser's authorization used to formalize a purchase transaction with a supplier. A purchase order, when given to a supplier, should contain statements of the name, part number, quantity, description, and price of the goods or services ordered; agreed-to

> terms as to payment, discounts, date of performance, and transportation; and all other agreements pertinent to the purchase and its execution by the supplier.

A purchase order is used for an initial or one-time transaction, so it needs to contain all of the details of the sale and all terms and conditions, as described in the definition above. Most purchase orders are electronically submitted such as through a cloud-based system, but multiple paper copies could also be sent. In either case, multiple functional areas need to receive information on open purchase orders.

Blanket Purchase Orders

A **blanket purchase order** is defined in the *Dictionary* as

> a long-term commitment to a supplier for material against which short-term releases will be generated to satisfy requirements; [it] often cover[s] only one item with predetermined delivery dates.

The blanket purchase order replaces shopping for competitive bids for the duration of the contract or use of multiple purchase orders with the same supplier. Use of blanket purchase orders is the simplest form of efficiency improvement a purchasing functional area can make, because it significantly reduces ordering costs. The blanket purchase order contains all master terms and conditions, so these parts of the contract do not need review again until the expiration of this master contract. Routine order releases are used for individual purchases under the blanket purchase order. These releases specify the delivery date and receiving functional area, since these can differ from release to release and cannot be on the blanket purchase order.

Important things to negotiate in a blanket purchase order include quantity discounts, delivery lead times, quality, and other terms. It is important for both the buyer and the supplier to forecast the anticipated demand for the material(s) over the course of the agreement, which is often six months, one year, or now often for longer durations. Suppliers use this demand information to ensure that sufficient capacity or inventory will be available at a reasonable cost. Renegotiations can address quantity trends, new prices, new quantity discount schedules, or supply of different items. Blanket purchase orders need exit clauses related to poor supplier performance.

E-Procurement

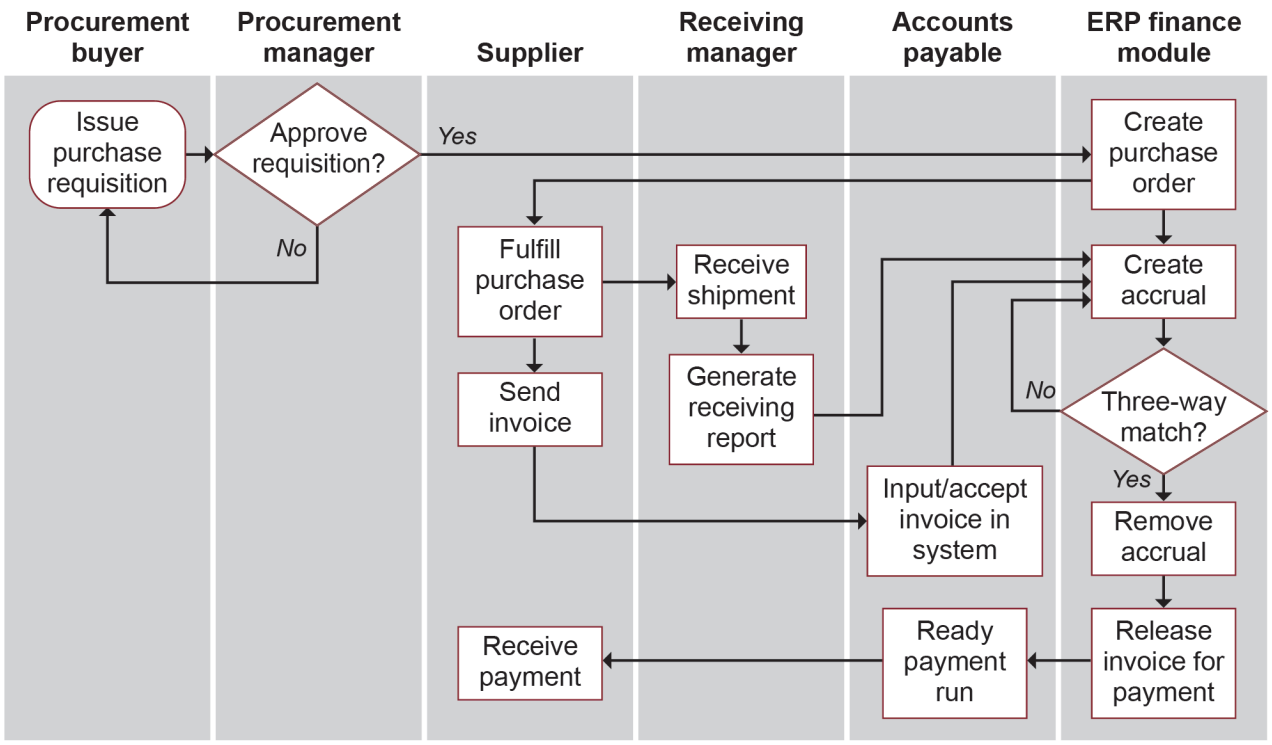
E-procurement can be used to place orders. This is addressed elsewhere but involves auctions, reverse auctions, exchanges, or portals.

Reconciling and Approving Invoices for Payment

As the receiving and payment process in Exhibit 3-19, a purchase requisition needs to have a check and balance in the form of a supervisory approval. An approved requisition results in a purchase order. Once the supplier provides the goods (or services), receiving does a three-way match to verify that the quantities and other details on the purchase order in the receiving report match the packing slips and

the invoice. When the purchase order is initially created, finance creates an accrual, which is basically a temporary record of the intended payment. After a correct three-way match, the accrual is removed, finalizing the transaction in the system so the payment can be released. If everything is in order, the order is approved for payment.

Exhibit 3-19: Receiving and Payment Process



Receiving is not a value-added activity in the eyes of customers, so it is best to minimize the time spent on this step. While receiving is responsible for counting all the units and inspecting them for damage (the use of digital photos of the goods and regular communications between the parties can speed this process), it might use random sampling for very large shipments as well as automation such as bar-code readers on conveyor belts and so on. Receiving can also develop partnerships and find ways to certify to key suppliers that inspections aren't needed.

Order Tracking and Expediting

Track and trace is needed for providing visibility and a chain of custody for product origins. Since this subject is addressed elsewhere, here the discussion of order tracking is focused on the need for various functional areas to track the status of open orders until their completion.

To **expedite** is "to rush or chase production or purchase orders that are needed in less than the normal lead time; to take extraordinary action because of an increase in relative priority" (*APICS Dictionary,* 16th edition).

Expediting can be applied to any stage of the supply chain. We'll consider expediting of supply (source and make) and of transportation (deliver).

Order Tracking (Internal)

Tracking the status of open orders is important to the following internal functional areas:

- Purchasing needs to be the primary party tracking the status of open orders and providing information on exceptions.
- Sales may need to notify customers of potential delays or other issues.
- Accounts payable and other finance functions such as treasury need to forecast future accounts payable obligations per period so they can ensure sufficient liquidity or invest excess funds.
- Accounting needs to ensure that financial records are accurate.
- The requesting functional area needs to be able to look up open orders by their order number and be kept informed of any issues or delays.
- Receiving needs to forecast its inbound workload and receiving space requirements per period.
- Traffic needs to use inbound inventory requirements to schedule carriers or internal delivery capacity and deliveries to avoid bottlenecks.

Typically, enterprise resources planning (ERP) systems automatically provide these various status updates. An order remains open in all of these functional area systems until it been received and properly accepted and, for financial records, until payment has been authorized.

One example of an exception that one of these parties can report is a receiving discrepancy report. Receiving will prepare a list of receiving exceptions that need to be investigated or resolved. This can be from incorrect quantities, unacceptable quality, or the wrong items being received. A discrepancy such as this could result in needing to expedite supply or transportation. Expediting could also be initiated by sales or an external party.

Expediting of Supply

Expediting of supply is something that should be very rare indeed in a well-managed system, because it often reduces profitability and causes other unintended side effects such as harming customer service for customers being bumped. However, expediting is sometimes necessary because not everything goes according to plan or a customer is important enough or willing to pay enough to make it necessary or worthwhile.

What creates the need for expediting (real or apparent)? In many cases, expediting is caused by inventory shortages, which are in turn caused by poor demand forecasting. The result is that salespersons start competing against one another to get their customers' needs satisfied at the expense of other salespersons' customers. Salespersons are often willing to spend a great deal of time expediting, by which we mean cajoling various suppliers or internal staff to get more done in less time or shift priorities. When this fails, salespersons may then escalate their expediting to senior salespersons or a vice president based on the importance of the customer. This scenario is an example of what happens when people focus on the short term and ignore long-term improvements. It creates an atmosphere of one emergency after the next. If they were to spend as much time on improving forecasts as they did at expediting, it would likely produce better and longer-lasting results.

Expediting is achieved with suppliers by asking them to prioritize the organization's needs above those of other customers. Depending on how important you are to them, your results may or may not be successful. They may charge the organization a premium for this priority, unless it is to correct an error on their part. Expediting is achieved with internal production by making requests to the master scheduler. Policy may dictate that this be a formal request with proper paperwork. The master scheduler will not allow for expediting of production in the frozen zone (the time period nearest to production when things have already been ordered and so on), so only production in the slushy or liquid zone should be a possible candidate for expediting. If expediting is necessary and the slushy zone production will not be ready soon enough, then another option might be to supply it from allocated inventory (e.g., safety stock or convincing another customer to delay receipt of inventory already promised to them).

Expediting of Transportation

Expediting of transportation can take the form of the shipper telling the carrier that a particular shipment needs to move to its destination as fast as possible and without any delays. This type of request may involve paying an expediting fee if the goods need to arrive before stipulated in the shipping contract. It may also not be possible to expedite a delivery much if the process is already efficient.

Another way to expedite transportation is to ship via a faster mode of transport if the shipment isn't already in transit. Just as a commuter may use a ride-share service when a bus will take too long, this may involve using an overnight delivery service if the units are small and light enough for these services to handle, or it could involve upgrading from ground to air transport, again depending on what is being shipped. If expediting is being done at the request of the customer, any extra costs, including administrative costs, would normally be passed on to the customer. If it is being done to fix an error or backlog, the organization will need to assume this expense.

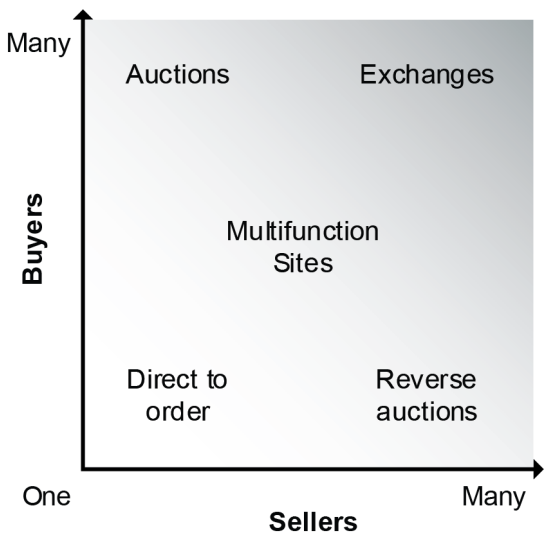
Organizations can measure the amount of expediting that is being done and its costs so they can determine the savings that can be gained if these costs can be avoided.

E-Procurement

Portals and trading exchanges are not exclusive to procurement; for example, they could be used with customers when the organization is on the selling end of the transaction or with logistics such as for finding transportation carriers.

Exhibit 3-20 shows the types of online exchanges and other transaction models by the number of buyers and the number of sellers involved in each transaction.

Exhibit 3-20: Business-to-Business Digital Transaction Models



Portals

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

> a multiservice website that provides access to data that may be secured by each user's role. Users can aggregate data and perform basic analysis.

Portals work over web browsers to enable people to more easily interact with systems or other persons. They provide faster access to information than a person could achieve in collecting, sorting, and aggregating the information on his or her own. Individuals can make custom views and perform self-service functions. Portals can be independently or privately owned, or they can be jointly owned and used by a consortium of organizations. Portals increase information reach and reduce distribution cost.

Consumer Versus Business Portals

Consumer portals are multiservice websites for consumer interactions, including personalized home pages, email, online shopping and search, and news and entertainment services. Examples include Amazon.com or Yahoo.com.

Business portals allow users to aggregate and perform basic analysis on information relative to their job. Organizational intranets and extranets are examples. Portals give employees and trading partners access to data according to each company's and each user's role. To ensure identity authentication and security, some portals are the only allowed method for communications across enterprises. Portals can gather and continually update both external and internal sources of real-time information to determine customer priorities and make employees more productive. External information can be consolidated from external trading partners, the internet, and industry information services; internal information includes all attached transactional and analytical databases. Often portals are connected with or are a direct output of customer relationship management (CRM) or supplier relationship management (SRM) systems.

SRM Portals

SRM portals allow individuals to view and react to the effects of production changes on supplier product or service availability and to see exception-based information and forecasts based on point-of-sale data. Buyers can see suppliers' available-to-promise inventory. The data are presented on a dashboard that allows users to configure what items are tracked. Often a user has no ability to modify the data, which is ideal for partners who need the information but should not be able to change it. For example, a company's suppliers might be given access to a portal to see up-to-the-minute requirements. Suppliers could use the portal to send and receive communications such as to confirm capacity and order status or receive a demand-pull signal for orders.

Trading Exchanges

A physical exchange—such as a stock exchange—creates a space for buyers and sellers to transact business efficiently. Similarly, a trading exchange, also called a B2B marketplace, creates a virtual market in which buyers and sellers can optimize, automate, and coordinate transactions. Automating the procurement process using trading exchanges lowers the cost per transaction and increases market reach for both buyers and suppliers.

Exchanges occupy the many-to-many quadrant of the chart in Exhibit 3-20. Exchanges can be called horizontal marketplaces when used across industries and vertical marketplaces when used by only one industry. The *APICS Dictionary,* 16th edition, defines these terms as follows:

> **Horizontal marketplace :** An online marketplace used by buyers and sellers from multiple industries. This marketplace lowers prices by lowering transaction costs.
>
> **Vertical marketplace :** An online marketplace connecting buyers and sellers within the same industry. It enables lower prices by lowering transaction costs.

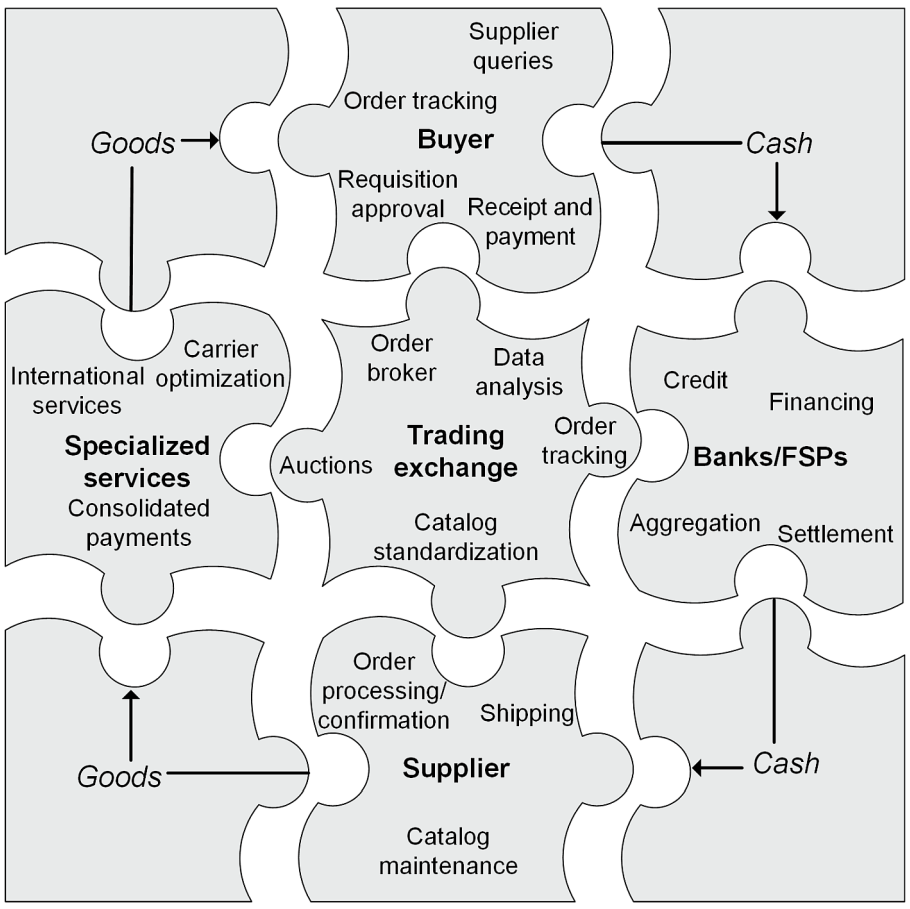
A successful exchange will result in faster decision making, lower inventory, and better collaboration, planning, and production. Trade exchanges include the following:

- Supplier and buyer broker services
- Supplier and product search functions
- Bidding events, including setup and prequalifying bidders
- Cost-savings identification
- Access to a larger market
- Supplier identification and support
- Online catalogs listing products, sales promotions, and quantity pricing
- Online SRM services, including strategic sourcing for direct materials
- Open, standards-based systems for automated connections
- Billing and payment processing for faster transfer of funds to suppliers

Some exchanges include a full range of SRM services and analytics, and they may also provide supplier certification to give buyers some assurance that suppliers meet certain predefined capabilities.

Exhibit 3-21 shows the complex interactions among partners in a trading exchange. The exchange is at the center because it serves as a hub for numerous transactions among the community. Exchanges facilitate collaboration because members can avoid forming multiple individual interfaces.

Exhibit 3-21: Trading Exchange Community Interactions



A good starting point in this cycle is at the bottom of the diagram where a supplier uploads catalog information to the exchange. The exchange ensures that the catalog is in a format to allow automated searches.

Buyers perform product searches, and matches from suppliers are aggregated. A highly detailed search can use an automated RFQ (request for quotation)/ITT (invitation to tender). Exchanges may help buyers and/or sellers prepare bids or assist buyers in writing more complete queries. Bidding events may require hours of preparation. This may come down to traditional procurement activities or be performed by a third party for many consumers, creating economies of scale. Annualized contract negotiation or a one-time purchase order can be initiated. Supplier availability is communicated to the buyer, and the exchange confirms the order. The transaction is communicated to the bank or financial service provider (FSP), logistics services, and carriers.

Exchange Ownership Models

B2B marketplace ownership models include the following:

- **Independent public trade exchange (ITX) or public marketplace.** These are public sites often used for indirect materials and commodity purchases where price is the primary factor and where any buyers and sellers for a particular market meet to gain access to a wider mark et and find the best deals.

- **Private trade exchange (PTX)** or private marketplace. According to the *Dictionary,* these are

  > trade exchange[s] hosted by a single company to facilitate collaborative e-commerce with its trading partners. As opposed to public e-marketplaces, a private exchange provides the host company with control over many factors, including who may participate (and in what manner, how participants may be connected, and what contents should be presented, and to whom). The ultimate goal might be to improve supply chain efficiencies and responsiveness through improved visibility and collaboration, advanced integration platforms, and customization capabilities.

  Trading may occur between members or only with the owner. PTXs are formed by market-dominant companies. Most private exchanges are members-only sites, but they do not usually charge fees and do not force suppliers to compete on price alone. PTXs have been developed by Volkswagen AG and BMW AG in the automotive industry and by utilities such as the Tennessee Valley Authority and the Kansas City Power and Light Company.

- **Consortia trade exchange (CTX)** or consortia-based marketplace. The *Dictionary* defines a consortia trade exchange as

  > an online marketplace, usually owned by a third party, that allows members to trade with each other. This site lowers members' search costs and enables lower prices for the buyer.

  CTXs are open or member-based sites formed by a consortium of companies, generally within the same industry. These some-to-many sites are semipublic, in that all members are allowed to trade with one another and price is often a major factor in purchases. There is a strong focus on finding new suppliers on these sites. Excess inventory and capacity is frequently traded in a clearinghouse. Ford Motor Company, General Motors Corporation, and DaimlerChrysler AG formed a consortium-based exchange, Covisint, in 2000. Covisint has been owned by a Canadian organization since 2017 so it serves as the third-party intermediary. Covisint has expanded into health care, government, oil and gas, and financial services.

- **Virtual trading exchange.** A **virtual trading exchange** is "an online trading exchange that enables both information integration and collaboration between multiple trading partners" (*Dictionary*).

Private exchanges are very costly; companies with a high transaction volume or a large number of suppliers should consider a private exchange because the larger number of transactions reduces the cost per transaction. Companies with few suppliers or low transaction volume should consider an independent public marketplace to keep costs down or a consortia-based marketplace to consolidate their supplier base with others.

Private exchanges are desirable when partners want high security in data exchange. However, they should determine supplier interest in joining a private exchange. The best candidates are those that

have strong market position or exclusive products or services. If the company has market dominance, it cannot gain much from aggregating demand with smaller businesses. The private exchange can help retain the unique brand value. When the company has unique business capabilities such as a unique processing model, then a private exchange can help leverage it.

Auctions

Auctions determine the value of a good or service on the open market. Winning a bid constitutes a contract. Most auctions require indifference as to who the buyer or seller is, so they are best for commodities (e.g., copper, wheat). Auctions should be avoided when delivery time, reliability, or quality are important. Auction items are solely differentiated by price, and any special features should be put in the description to show the item's value. Auctions benefit both buyers and sellers, with a balance of increased revenue, efficiency, and speed and reduced cost.

Types of auctions include the following:

- **Classic or forward auctions.** Classic auctions have one seller and multiple buyers who bid up the price for a product until the highest bidder gets the item.
- **Reverse auctions .** Reverse auctions are "internet auction[s] in which suppliers attempt to underbid their competitors; company identities are known only by the buyer" (*Dictionary*).
- **Dutch auctions.** Dutch auctions have one seller and multiple buyers for multiple but finite quantities of the same item for sale. The price starts high and is lowered periodically. A bid immediately constitutes a contract for sale at the current price. U.S. Treasury securities are offered by Dutch auction.
- **Demand management auctions.** Demand management auctions are clearinghouses to liquidate excess supply (e.g., hotel rooms); buyers and sellers must be indifferent to the other party.
- **Stock-market-style auctions.** Stock-market-style auctions have dynamic pricing based on buy and sell offers and multiple buyers and sellers for commodities.

Trading Exchange Benefits and Risks

Benefits for buyers include

- Better control over negotiated purchasing agreements
- Standard product specifications that reduce duplicate entries for parts and duplicate suppliers for the same part
- Reduced administrative costs
- Lower unit costs
- Faster response to needs and faster time to market
- Improved catalog accuracy, reducing billing and pricing errors

- Reduced logistics and transportation costs due to better volume leverage.

Risks to buyers include

- Lower-quality goods
- Nonconformance to specifications
- More product rework and returns
- Long-term loss of suppliers and fewer skilled suppliers.

Forcing supplier concessions could lead, in the long term, to worse supply chain coordination, poor planning, and adversarial relationships. Key suppliers should not be moved to cost-based exchanges.

Benefits for suppliers are less clear than those for buyers. They include

- Automatic connections and lower transaction costs
- Access to a wider market
- Faster payment receipt (order to cash)
- Ability to offer all available inventory
- Future bidding improved by knowledge of winning bid; shows need for cost reduction
- Better and more accurate catalogs for increased order accuracy
- Volume leverage, reducing logistics and transportation costs
- Reduction of replenishment lead time
- Supply and demand planning and collaboration, if offered.

However, these benefits must be weighed against significant reductions in revenue. Low bid winners may have unprofitable margins.

Risks to suppliers include

- Possibility that an option contract may lock up the supplier’s capacity even when the business is not guaranteed
- Fewer investments in improving processes due to tighter margins
- Possibility of being driven out of business
- Possibility that the buyer will use the seller’s data to get a lower bid elsewhere
- Exchange integration costs for software and connectivity.

Suppliers whose value is not purely dependent upon low price (e.g., those with brand recognition for quality or dependability) are less likely to participate. If 100 suppliers participate in an online auction but only one supplier wins the bid, the bid was a waste of time for the other 99 suppliers. Suppliers that do not see results may drop the service, especially with public horizontal exchanges. Suppliers are better off building long-term relationships, reserving exchanges to liquidate excess inventory. Whenever they win bids, their goal should be to start a personal relationship with these companies.

Index

D

E

F

G

H

I

Q

R

S

T

U

V

W