CHAPTER 30

Supply Chain: Better, Faster, Friendlier Suppliers

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About This Chapter

This chapter deals with how producers and purchasers can develop better relationships with their suppliers. This will lead to lower-cost supplies and components delivered on time and on budget. It discusses the shift that is taking place in relationships between suppliers and producers/purchasers. This shift from adversarial supplier to an important partner often was the case in the past. Partnering with suppliers can help achieve the objectives of faster, cheaper, and friendlier supply relationships.

High Points of This Chapter

1. The triple role of supplier, producer, and customer is important to understanding supply chains and supplier relations.
2. Partnering among suppliers, producers, and customers helps maximize value at all levels of the supply chain.

3. Application of Lean supply chain principles can lead to improved speed (shorter replenishment times).
4. Application of the Juran Trilogy® to the supply chain can help improve speed and is most effective at reducing supplier and producer costs of poor quality (COPQ).
5. Effective supplier scorecards help the producer to objectively select and retain the optimal supply base. They assist with effective planning, control, and improvement of the supply base and supplier management process.
6. Supplier auditing is an important support for the supplier scorecard system.
7. Supplier audits should lead to continuous improvement activities by suppliers.

Introduction

In many organizations—both those that manufacture goods and those that provide services—there is a heavy reliance on supplied materials, components, and products. Many manufacturers are truly just integrators of hundreds or thousands of parts into a final product. Take the automobile producer, for example. The producer buys myriad parts from engines down to small fasteners. Little of the content of the final automobile is produced in the manufacturer's facility (a notable exception often being stamped body panels). Other industries such as aerospace, defense contractors, and consumer goods manufacturers follow this pattern of purchasing and integrating components into a final product. The days of highly integrated manufacturers who produce everything from raw materials to finished product are, for the most part, gone.

The situation described here is often more complex. The raw material supplier is usually the only one who does not do some kind of transformation or assembly with his product. In a typical supply relationship:

- The raw material suppliers supply small component manufacturers, for example, plastic resin.
- The small component manufacturers supply the subassembler, for example, molded parts.
- The subassemblers supply subsystem integrators, for example, a louver for an instrument panel.
- The subsystem integrators supply final product integrators, for example, the instrument panel.
- The final product integrators supply the sales outlets or consumers, for example, a completed automobile.

Or take the example of a service provider who uses supplied products in the performance of their service; a cleaning service that cleans several high-rise office buildings using a high volume of cleaning supplies from multiple suppliers; a retail outlet purchasing multitudes; and large department stores, consumer electronics stores, and the like using thousands of suppliers.

The reality is that each level of supplier, from the supplier of raw materials up to the ultimate supplier to the end user, must supply good quality products, at the right price and at the right time, which makes the subject of supply chain and supplier relations very important to today's organizations of all kinds.

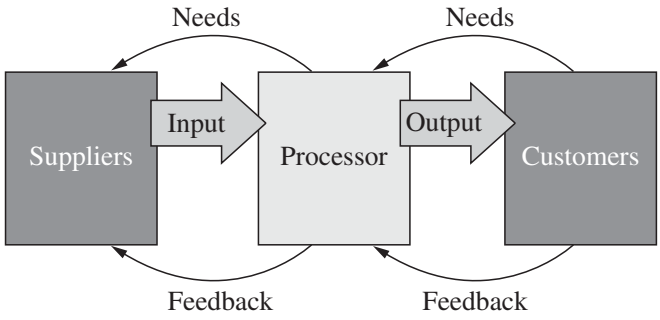

FIGURE 30.1 The triple role. (*Juran Institute, Inc.*)

The Triple Role

Every processor team conducts a process and produces a product. To do so, the processor team carries out three quality-related roles, which are depicted in Figure 30.1. The diagram shows the interrelation among three roles:

- *Customer*. The processor team acquires various kinds of inputs that are used in carrying out the process. The processor team is a customer of those who provide the inputs.
- *Processor*. The processor team carries out various managerial and technological activities to produce its products.
- *Supplier*. The processor team supplies its products to its customers.

To illustrate, the company is a processor team. In its role as a customer, it receives such inputs as:

- Information concerning client needs, competitive products, and government regulations
- Money from sales and investors
- Purchased goods and services
- Feedback from customers

In its role as a processor, the company converts these and other inputs into products such as sales contracts, purchase orders, salable goods and services, invoices, and reports.

In its role as supplier, the company provides clients with goods, services, and invoices, and provides suppliers with purchase orders, payments, and feedback information provided to all.

The concept of the triple role is simple enough. However, the application can become quite complex as a result of the large number of suppliers, inputs, processes, products, and customers. The greater the complexity, the greater the need for an orderly approach to quality planning.

Methods for managing the complexity of the relationships, as Dr. Juran described, among suppliers, producers, and customers are the subject of this chapter.

Friendlier Partners

As the subtitle of this chapter implies, the customer-processor-supplier relationships at all levels must be in the form of partnerships in order to succeed in today's marketplace. The

"old ways of doing business," in which relationships were often adversarial, no longer suffice. In your role as customer, you must find new and better ways to interface with suppliers. Since the idea of partnering is seen as a prerequisite for the other two (faster and cheaper), we will discuss this concept first.

Traditional Role of Purchasing

Following World War II, when growing demand for goods and services was satisfied by increasing plant capacity, operations was identified as the strategic component of an organization. Purchasing was relegated to a staff support role. The purchasing department's mission was to ensure that suppliers provided an uninterrupted supply of required goods and services, delivered on time and at the right price (where "right price" was usually interpreted as "lowest price," not "lowest total cost").

Personnel in purchasing departments developed competencies in supplier negotiations, bid evaluation and analysis, document administration, and market knowledge. Supplier negotiations were viewed as the major value-added activity of the purchasing department because supplier relations developed during these negotiations. This often resulted in adversarial supplier relations, which were focused on short-term performance. Availability and low price became the most important criteria for measuring supplier performance. As Carlisle and Parker wrote (1989), "This adversarial tendency … resulted in a great deal of management energy being spent on both sides in search of ways to capture some of the other's profit margin."

If a supplier change was made, little consideration was given to any resulting incremental costs incurred. The new supplier's product or service might deviate slightly from that of the original supplier, translating into costs in other areas of the production process. This propensity to change suppliers resulted in many disadvantages to the purchaser, including:

- Excess inventory because of obsolescence
- Production shutdowns because of installation or operation requirements
- Transition costs such as training or maintenance testing disposal costs
- Production disruptions because of poor quality detected after the testing had been completed
- Increases in variation in the finished product
- Increases in scrap, product defect, or customer dissatisfaction

Rarely were these costs identified, aggregated, analyzed, and reduced. Furthermore, as Deming (1981) stated, "No one can outguess the future loss of business from a dissatisfied customer." In the adversarial climate that prevailed, little opportunity for collaborative root cause analysis existed.

Moving from Adversary to Partner

Beginning in the late 1970s, the "Quality Revolution" grew from its roots in Japan to the rest of the world, and it was recognized that price-based purchasing decisions and adversarial customer-supplier relationships would no longer suffice. Companies began to recognize that timelines of delivery, after sales service, product development partnerships, and quality of products and services supplied were just as important, maybe even more so, than price.

But progress toward a friendlier environment was not linear. In the late 1980s and early 1990s, some customer purchasing functions returned to the old, adversarial approach to the

supply chain—in particular, suppliers to automobile manufacturers, who were pressured to offer lower and lower prices and sign long-term contracts, including annual "give-backs," as a condition of contract award. At General Motors, the pressure on suppliers during this time was especially great, largely because of the efforts of Jose Ignacio Lopez De Arriortua.

Lopez had made his reputation at the GM affiliate, Opel's, Rüsselsheim, Germany, plant. As Jonathan Mantle says in *Car Wars*, "[Suppliers] called him 'the Butcher.' Lopez squeezed suppliers until they screamed, and then squeezed some more." Thankfully, this reversion to tactics of the past didn't last long. By the mid-1990s, most companies were moving again toward a strategy of partnering with suppliers to achieve a better outcome for all. Lopez left GM for Volkswagen in 1992 and was later sued by the company for allegedly stealing trade secrets. The approach Lopez and GM took resulted in what Ed Rigsbee refers to as "The Boomerang Always Returns." "Suppliers cut back on their research for GM's needs and started giving their cutting-edge technology to Ford and Chrysler. Rather than GM getting more, in actuality, it got less."

For partnering to be effective, of course, the supplier must get something out of the deal. Often, companies will share cost savings with their suppliers as an incentive for better prices. A company that is truly committed to partnering will also offer assistance in, for example, achieving process breakthroughs that will allow the supplier to produce at a lower cost and supply in a more timely fashion. Other enticements include single source or majority volume of orders for the supplier partnership.

> "General Electric (GE) went after cost reductions differently. The company assembled appliance suppliers in November 1992 and announced 'Target 10,' asking suppliers for 10 percent cost reductions. The difference was that GE pledged its assistance to suppliers in finding strategies for the [cost] reductions" (Rigsbee, 2000).

By approaching the supply chain as partners, a consumer of their products and services can achieve shorter supplier lead times (faster) and lower costs of products and services procured (cheaper).

Faster, cheaper supplied goods and services result from optimization of the supply chain.

Quality Incorporated into Traditional Purchasing

Purchasing as a Strategic Process

Consider the potential opportunity if time, resources, energy, and management priorities focus on the processes by which these goods and services were scheduled, designed, manufactured, and purchased, rather than simply focusing on the acquisition alone. Quality and cost reduction opportunities could be identified, measured, and managed. Where two firms compete in identical markets, the ability of one firm to identify, measure, and manage these opportunities faster than another firm creates a clear competitive advantage.

Therefore, purchasing, while traditionally thought of as a utility, nonvalue-added function, is increasingly being recognized as a strategic function, an opportunity for process management and improvement, and a tool for achieving competitive advantage.

It's been calculated that supplied components account for 55 cents of every dollar of revenue an average manufacturer receives. If that cost can be reduced by only 5 percent, it means a 3 percent increase in profits. A similar equation applies to service providers. But, as Tully (1995) says, "Cutting purchasing costs has surprisingly little to do with browbeating suppliers. Purchasers at companies like AT&T and Chrysler aim to reduce the total cost—not

just the price—of each part or service they buy. They form enduring partnerships with suppliers that let them chip away at key costs year after year."

Importance of Supplier Quality

To identify supplier-relation opportunities and to capitalize on them, an understanding of suppliers' quality is of paramount importance. Consider the following:

- The costs associated with poor-quality suppliers are high. For one home appliance manufacturer, 75 percent of all warranty claims were traced to poor quality of purchased items.
- The growing interdependency of suppliers and end users in identifying and implementing such opportunities as "just-in-time" delivery, electronic data interchange (EDI), electronic funds transfer (EFT), cycle-time reduction, and outsourcing initiatives.
- The trend to minimize incoming inspection.
- The growing trend of purchase decisions being made not on lowest price, but on the total cost of ownership of the product or service.

These considerations require the purchasing function to abandon its traditional role of transaction-performance management. Expressions of this emerging approach are contained in statements from two eminent American companies.

From AT&T in 1995:

Mission: Provide worldwide professional procurement services that are a competitive advantage for AT&T and its customers. *Vision:* Be THE benchmark for procurement excellence.

From Chrysler Corporation:

Mission: Manage and prepare the extended enterprise to the maximum benefit of Chrysler and its customers.

The implications of this role change are profound.

- Supplier selection and management is no longer the sole prerogative of the purchasing department.
- Cooperation, collaboration, and joint problem-solving among internal customers, purchasing, and suppliers are required.
- Purchasing personnel focus on process, abandoning the focus on transaction.
- Within the end user's firm, the purchasing function is elevated to a strategic level and its transaction activities and responsibilities minimized or eliminated.

A successful transition to a strategic approach to purchasing requires everyone in an organization to embrace a new belief system concerning purchasing. In the transition, senior management will find it necessary to aggressively promote the new view, which might be summarized as follows:

Purchasing has become a key strategic process within our organization, requiring a staff of highly skilled professionals committed to working with our end users and suppliers, in a collaborative, problem-solving environment, facilitating quality and continuous improvement.

Shift to Strategic Purchasing

The differences between the traditional view of purchasing and the strategic view are dramatic. They are summarized in Table 30.1. The differences require some significant changes in culture and behavior.

Aspect in the Purchasing Process	Traditional View	Strategic View
Supplier/buyer relationship	Adversarial, competitive, distrusting	Cooperative, partnership, based on trust
Length of relationship	Short-term	Long-term, indefinite
Criteria for quality	Conformance to specifications	Fitness for purpose
Quality assurance	Inspection upon receipt	No incoming inspection necessary
Communications with suppliers	Infrequent, formal, focus on purchase orders, contracts, legal issues	Frequent, focus on the exchange of plans, ideas, and problem-solving opportunities
Inventory valuation	An asset	A liability
Supplier base	Many suppliers, managed in aggregate	Few suppliers, carefully selected and managed
Interface between suppliers and end users	Discouraged	Required
Purchasing's strategy	Manage transactions, troubleshoot	Manage processes and relationships
Purchasing business plans	Independent of end-user organization business plans	Integrated with end-user organization business plans
Geographic coverage of suppliers	As required to facilitate leverage	As required to facilitate problem-solving and continuous improvement
Focus of purchasing decisions	Price	Total cost of ownership
Key for purchasing's success	Ability to negotiate	Ability to identify opportunities and collaborate on solutions

TABLE 30.1 Traditional vs. Strategic View of the Purchasing Process

Total Cost of Ownership

The most fundamental shift in the purchasing professional's behavior is to base purchase decisions on the total cost of ownership. Taking a total process approach (rather than a transactional approach) to quantifying the total cost of ownership will result in the identification of supplier, end-user, and joint costs that will need to be identified and measured. Many of these costs will be reduced through joint problem solving. Table 30.2 offers a sample list of elements of total cost of ownership.

Supply Chain Optimization

The goal of a strategic purchasing function (one that partners with its suppliers and customers) is to facilitate the performance of the supply chain. This process facilitation includes

Category	Subcategory	Cost Component
Preacquisition	Preprocurement cost	Engineering/design
		Supplier survey
		Supplier audit/site visits
		Product testing/technical review
		Regulatory compliance
		Market assessment
		Customer reviews/briefings
Acquisition	Material equipment cost	Price of material/equipment
		Cost of special features
		Shipping/handling/storage
		Spare parts
		Leased items
		Taxes
	New technology costs	Modification/retrofit
		Additional training
	Foreign acquisition costs	Foreign surtax
		Import duties
		Foreign currency risk
		Additional testing requirements
	Installation/start-up costs	Labor
		Subcontractor
		Special testing
		Construction equipment
		Required overhead
		Training
		Special tools
		Service engineering
		Inspection
Ownership	Operating/maintenance costs	Administration/overhead
		Ongoing labor
		Routine testing requirements
		Ongoing training
		Energy usage
		Preventative maintenance
		Personnel required
	Inventory costs	Inventory carrying costs
	Failure costs	Cost of expected down time
		Replacement parts
	Obsolescence costs	Energy efficiency
		Productivity loss
	Other costs of ownership	Environmental impact
		Licensing, permitting
		Environmental control equipment
		Conformance costs
		Standardization costs
Disposal	Disposition cost	Removal salvage costs/value disposal

TABLE 30.2 Sample Checklist for Total Cost of Ownership Consideration

participation of the end users and suppliers. Supply chain optimization is the ongoing management and continuous measurable improvement in the performance of this supply chain, generating value for all involved. The entire supply chain must be considered, including indirect suppliers, manufacturers, distributors, and end users. Note that the key words in this definition are:

- *Ongoing*. Supply chain optimization is not an event, but an ongoing process.
- *Measurable*. The results of supply chain optimization are tangible benefits.
- *Improvement*. The foundation of supply chain optimization is continuous improvement.
- *All*. True supply chain optimization requires participation of all parties involved to share in the benefits.

Goal of Supply Chain Optimization

The overriding goal of quality-focused supplier chain optimization is increased customer satisfaction through the joint (suppliers and end user) creation of value in the supply chain. On the supplier side, participation in such an initiative, as supply chain optimization, extends beyond the role of the account executive and includes the participation of those actually involved in the manufacturing and delivery of the product in question.

In addition, on the end-user side, participation in such a venture extends beyond the purchasing department, and includes participants from the core operating business units. In fact, while such a team effort is typically facilitated by a purchasing individual, the team should be led by, and accountability of results assigned to, a member of the core business unit.

Supply chain optimization creates value in the following six areas:

- *Quality improvement*. Continuous reduction in product variation and the ability to plan and build quality into each component and service, with measurable results
- *Cycle-time reduction*. Continuous reduction in the time required to make and implement key decisions and perform various processes
- *Cost of poor quality reduction*. Continuous measurement and reduction of costs associated with the prevention, inspection, and failure resulting from poor quality
- *Total cost of ownership reduction*. Purchasing decisions based on total cost of ownership, including preprocurement, acquisition, operation, and disposal costs, rather than price alone. Continuously manage the ongoing acquisition based on the identification and elimination of root-cause cost drivers, which contribute to total cost of ownership.
- *Technology/innovation*. Continuous identification and deployment of value-added technologies through joint planning and development
- *Shared risk*. Continuous identification of opportunities to identify and share risk throughout the supply chain

Successful supply chain optimization requires that the sourcing process operate as a single seamless entity, rather than as a set of discrete processes. Members of the supply chain establish goals and work together toward these goals, which target the satisfaction of customer needs.

Faster

For our purposes here, we will define faster supply as a shortening of the supplier's replenishment lead time. Replenishment lead time is defined as the time from placement of an order to the supplier until the order is received and can be used by the producer.

Replenishment lead time is the key to the efficient operation of any producer. If the producer's process runs faster than suppliers can replenish, then stock-outs will occur unless sufficient safety stock is held by the producer or in a finished goods inventory by the supplier. Inventories are wasteful and costly—the cost of money invested in the inventory, the floor space required to store the inventory, and so on. But stock-outs are wasteful too, and may be even more costly than the safety stocks held to avoid them. In either case, the producer must either:

- Slow his pace of production to avoid stock-outs, which may result in inability to meet his customer's delivery time requirements, or
- Work with suppliers to reduce replenishment lead times to a point that allows the producer to meet his customer's demand pace.

When one considers the entire supply chain (see Figure 30.2), this problem becomes of even greater concern. Say that a producer's tier 1 supplier is experiencing long replenishment times from the tier 2 supplier and the tier 2 supplier is experiencing long lead times from the tier 3 supplier, and so on. It's easy to imagine how the producer's safety stock requirements to sustain production and supply in a timely manner to his customers would grow exponentially.

There are three things a producer must do to ensure the shortest possible replenishment time from his suppliers:

First, understand and optimize the logistics of getting product shipped or services delivered to your location. Of course, this includes understanding the distance between the

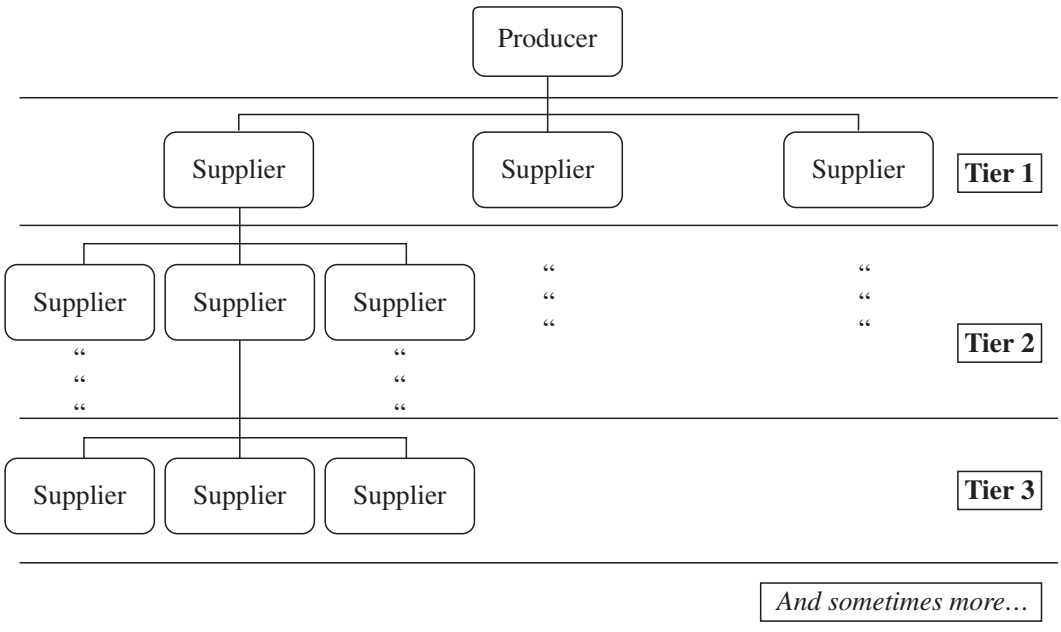

Figure 30.2 The supply chain.

supplier's location and yours, but it's more than that. Are deliveries scheduled frequently enough? If they are scheduled weekly, for example, could they be scheduled daily or several times a week instead? More frequent deliveries can remove days from replenishment time—days that will then not need to be covered with safety stock.

Many producers have addressed this issue by trying to find suppliers geographically closer to their manufacturing facilities. In some cases, manufacturers like Toyota have assisted potential suppliers in starting facilities nearby or even next door to the Toyota assembly plant. The idea of geographically shortening the supply chain is a good one, but is not always practical for all producers. But the physical length of the supply line must always be considered when making purchasing decisions. Even if a supplier in, say, India or China has a much lower cost per widget, the additional costs of safety stock, work in progress, and finished goods inventory needed to compensate for the long distance supply, as well as the transit cost itself, may outweigh the piece cost savings. Consideration must be given to the costs of less-than-desirable logistics when making purchasing decisions.

Second, help suppliers "get Lean." You may not have resources within your organization to directly contribute to the training of suppliers and facilitation of their Lean events, but you can require them to undertake a Lean management implementation as a contract condition. Incentivize this activity by sharing the savings you reap as a result of shorter replenishment times and the resulting lower inventory level with the supplier. They will, of course, also reap benefits from reduction of waste in their facilities.

After accomplishing the above with the first-tier suppliers, add incentives for them to do the same with tier 2, 3, and lower-level suppliers. Ultimately, the objective is to shorten the time it takes from production of the lowest-level product, usually raw materials, until the final product is complete and ready to ship to your customer.

Recall the triple role discussed previously. At whatever level of the supply chain your company operates, one of your roles is that of producer of your products. It is in that role that you should consider the application of Lean supply chain techniques as described here.

To be manageable, you should consider doing the replenishment time reduction activities with one key supply chain first—one of your most important tier 1 suppliers and his lower-level suppliers. Use Juran's Pareto principle to prioritize those suppliers for first action considering factors such as annual value supplied, length of replenishment times, and so on.

Third, propagate the success. According to Phelps, et al (2003), "Since you selected a subset of your entire supply chain for this application of the Lean supply chain approach, you will want to share your successes with your other suppliers in preparation to begin the process with another group of suppliers. This is a way to pique their interest as well . . . [and] give them a sense that you are indeed helping your supply base improve. . . . "

As you propagate the improvements to each successive piece of your supply chain, the benefits of faster supply will build exponentially, just as the waste, nonvalue-added activities, and inventories have in the current state. These Lean supply chain approaches support the second aspect of improved supplier relations, "cheaper," but there are more steps you can take to obtain the best prices from your supply chain.

Cheaper

While creating a Lean supply chain focuses primarily on speed, it also contributes to lower costs in production by reducing waste in processes. Additional actions to achieve lower costs from suppliers focus primarily on reduction of cost of poor quality (COPQ) by improving the quality of producer procurement processes and supplier products and processes.

COPQ is one element of overall cost of quality; the other is cost of attaining quality, which includes prevention and auditing activities. COPQ consists of inspection costs and failure costs, both internal and external.

How to Reduce COPQ Related to Supplier Relations

It is important to understand that COPQ is either caused or experienced in each of the three phases of the Juran Trilogy®: planning, control, and improvement. In each of these phases of managing for quality, actions can be taken to reduce COPQ related to:

- Poor planning by the producer: design deficiencies, failure to clearly communicate requirements to suppliers
- Poor control by the supplier: incapable processes, lack of control plans, lack of mistake proofing, poor detection
- Lack of breakthrough improvement projects, which, if properly executed, could have perhaps the greatest impact on reducing COPQ

Once an organization has been established to facilitate quality supplier relations, the trilogy of quality planning, quality control, and quality improvement can be applied to the supply chain. Following is a detailed explanation of the activities and deliverables of these three phases of managing for quality and how they relate to supplier relations.

Planning for Supplier Relations

According to Kevin Fitgerald (1995), "Honda's success on this continent [North America] is a direct result of the company's overall philosophy of manufacturing … manufacturing's success depends on two groups: the people who make the products, and the suppliers that provide the parts and raw material from which the products are made."

Planning for supplier relations is the activity of identifying customer needs and analyzing and developing a sourcing strategy to meet those needs. One of the key deliverables of the planning process is an initial model detailing the customer's total cost of ownership of the subject commodity. Thus, data collection and analysis will also be required throughout the planning process. The focus of this planning process is the identification of the appropriate customer and assessment of the current and future needs of these customers for the commodity in question (Table 30.3). Additionally, as the output of the planning process is a recommended sourcing process flow, a thorough understanding of the supply industry structure, dynamics, and trends is essential.

The planning process requires:

- Early customer involvement to identify current and future sourcing needs
- Extensive research and data collection regarding the alternative processes available to satisfy these needs

Most successful source planning has followed a methodology similar to the following:

Step 1. *Document the organization's historic, current, and future procurement activity.* In the absence of planning for supplier relations, it is assumed that purchasing is generally handled in a reactive business process, which satisfies immediate, local operational needs. The documentation of the historic, current, and anticipated purchase activity across an organization's various business units enables that organization to take the first necessary step toward achieving purchasing leverage; synergies within and between organization business units;

Process	Definition	Process	Definition
Quality planning	The activity of developing the products and processes required to meet customer needs	Planning for supplier relations	The activity of identifying customer needs and analyzing and developing a sourcing strategy to meet those needs
Quality control	The activity of evaluating actual performance, comparing actual performance to goals, and taking action on the difference	Control for supplier relations	The activity of evaluating suppliers' performances, selecting the vital few suppliers capable of optimizing performance, and the measurement of supplier performance
Quality improvement	The activity of raising quality performance to unprecedented levels	Improvement for supplier relations	The activity of identifying and acting upon sourcing process improvement opportunities

TABLE 30.3 Juran Trilogy® Applied to Supplier Relations

and a strategic, collaborative, proactive approach to managing the sourcing process. Available tools are data collection and trend analysis.

Step 2. *Identify a commodity from the procurement activity that represents both high expenditure and high criticality to the business (quadrant IV commodities).* A simple Pareto analysis will often reveal the vital few commodities that drive an organization's purchasing needs and costs. Focusing resources on these vital few commodities will enable an organization to begin to capture the value of supply chain management early. Available tools are Juran's Pareto analysis, data histograms, stratification, and management presentations.

Step 3. *For this commodity, assemble a cross-functional team.* The team includes representatives of the customer and of company functions—technical, purchasing, quality, and financial. The team's mission is to define the customer's sourcing need for this commodity and to develop a sourcing strategy that will meet this need. Available tools are brainstorming, team building, and flow charting.

Step 4. *Determine the sourcing needs of the customer through data collection, survey, and other needs-assessment activities.* This is the critical step, which, if not properly and thoroughly conducted, can derail any well-intentioned cross-functional team. It is often fatal to assume that the customer's needs are obvious. Extensive data collection through surveys, customer visits, and focus groups will pay off later on. Available tools are brainstorming, data collection, flow charting, cause-effect diagrams, force field analysis, hypothesis formulation, and testing.

Step 5. *Analyze the supply industry's structure, capabilities, and trends.* Once the customer needs have been identified and validated, an industry analysis is required. It is the supply chain, and not the purchase itself, that will ultimately delight the customer with fitness for purpose and value. Thus, the various supply chains available, and their performance and cost structures, must be understood. This is an extensive research phase of the planning process, and might require the team to split temporarily into several subteams. Available tools are industry data collection and analysis, flow charting, benchmarking, and process capability analysis.

Step 6. *Analyze the cost components of the commodity's total cost of ownership.* This, too, will require extensive data collection and analysis, and even benchmarking, to identify how others have managed this commodity. This model of total cost of ownership will be redefined, refined, and optimized throughout the life of the commodity management team. Available tools are data collection and analysis, brainstorming, flow charting, cause-effect diagrams, histograms, and Pareto analysis.

Step 7. *Translate the customer needs into a sourcing process that will satisfy the customer and provide the opportunity to manage and optimize the total cost of ownership.* The customer needs identified in Step 4 will need to be mapped into the various alternative sourcing processes identified in Step 5. An optimal sourcing strategy can be determined by optimizing the total cost of ownership, based on the results of Step 6. Translation requires extensive dialog and feedback to identify and gauge fitness for purpose of the sourcing strategy. Available tools are data collection and analysis, brainstorming, flow charting, cause-effect diagrams, histograms, Pareto analysis, force field analysis, and customer and supplier visits.

Step 8. *Obtain management endorsement to transfer the sourcing strategy into operation and implement it.* This strategy should now be transferred from the cross-functional team to operations management for implementation. The "selling job," which is often required to facilitate change, is reduced by the ongoing involvement on the team of those affected. The strategy should include, at a minimum, the following: scope (global, regional, local), terms and condition of agreement, and method of end-user release. A dry run or a pilot test should be conducted to demonstrate feasibility of concept. Once the pilot has been implemented and the feasibility of concept demonstrated, the revised process should proceed through a site-by-site acceptance test and implementation. Some training will be required. Available tools are executive briefing, pilot testing, process debugging, acceptance testing, and training.

The planning phase of the sourcing initiative in all likelihood resulted in some consolidation of the supplier base, where cross-divisional or multiple business units identified opportunities to exercise economies of scale by consolidating similar purchasing activity with fewer suppliers.

The following is an illustrative example of the planning process applied to the sourcing of personal computers at a financial institution.

Data analysis indicates that most PCs are purchased at local computer stores from the winner of a three-bid competition. As a result, there is little standardization in the hardware and software used at the institution. PCs are historically purchased in small quantities, generating significant work for the purchasing, accounts payable, and information technology support groups, who acquire, pay for, install, maintain, and manage the equipment.

Analysis reveals that purchase price is actually a fraction of the total cost of ownership of the personal computer. Equipment support, software evaluation, training, and inventory control also represent significant hidden costs.

In this case, the sourcing process recommendation is to standardize the equipment and software, negotiate purchase and service agreements with a single computer distributor with wide geographical coverage, and limit purchases to semiannual bulk acquisitions. Several local charities are identified for the donation of obsolete equipment. The supplier with the agreement now has specific key performance indicators by which its performance can be measured and monitored.

Control for Supplier Relations

Certainly control must be applied at the supplier level to ensure that the producer will receive defect-free products. Essential to this assurance is measuring and establishing adequate process capability—Cpk of greater than 1.33 or Sigma level greater than 4σ. This level of capability

is usually only achieved by the application of robust design methods, such as Design for Six Sigma (DFSS), and/or breakthrough improvement methods like Lean and Six Sigma.

Despite a capable process, special causes may sometimes result in the loss of process control. When this happens, a good control plan that provides for quick restoration of control should be a requirement that is part of supplier acceptance criteria. Central to the quick restoration of control is a robust root cause and corrective action (RCCA) approach. The wise producer will apply his resources to help suppliers attain adequate process capability and robust control plans.

Control is applied to supplier relations in evaluating supplier performance and selecting the vital few suppliers capable of optimizing performance. As in planning, the focus of control must be the satisfaction of customer needs. However, as a result of the completed planning process, several criteria for performance evaluation and measurement are already in place. The purpose of control is to maintain acceptable performance. Applied to supplier relations, the purpose of control is to maintain the level of customer satisfaction at the level defined in the planning process.

The suppliers identified in the planning process are typically those suppliers that can perform the revised sourcing process. A thorough, ongoing evaluation conducted by a cross-functional team further narrows the supplier base and helps facilitate the selection of those few suppliers who will be able to optimize the total cost of ownership of the commodity. Therefore, it is in the application of control that the evolution begins from the traditional purchasing approach toward supply-chain management.

Control is a process requiring:

- Clearly defined supply chain quality goals established in planning
- Extensive, ongoing data collection and evaluation of the performance of the suppliers against these supply chain quality goals
- Corrective action where required

Most successful sourcing control processes follow a methodology similar to the following:

Step 1. *Create a cross-functional team.* The cross-functional control team includes customer, purchasing, technical, and operation personnel. Its mission is the ongoing management, measurement, and evaluation of the performance of the supply chain process established by the planning team during the planning phase. The team will initially need to identify quality goals and key performance indicators. Extensive customer involvement with the team should be expected. Available tools are brainstorming, team building, flow charting, data collection, and management presentation.

Step 2. *Determine critical performance metrics.* Performance metrics will have been proposed in the planning phase. However, the control team will need to identify and establish processes for capturing and reporting this information. Extensive supplier involvement should be expected in this step. Available tools are data collection, flow charting, check sheet, run chart, scatter diagrams, and process capability indexes.

Step 3. *Determine minimum standards of performance.* In addition to critical performance metrics, the team establishes minimum standards for suppliers before they are considered for further strategic development. These standards would likely include several financial, legal, and environmental considerations. Some minimum acceptable quality standards might also be proposed, such as percent defective, warranty performance, and delivery considerations. These minimum standards, along with the critical performance metrics established in Step 2, are communicated to both the customer and supplier community (for more elaboration see the section, "Implementing and Using Supplier Scorecards"). Available tools are brainstorming, data collection and analysis; management, supplier, and customer presentation.

Step 4. *Reduce the supplier base.* The team eliminates suppliers unable to achieve the minimum performance requirements, and shifts activity to suppliers who do achieve those performance standards. Through the application of the minimum standards of performance, the control process offers another opportunity for reducing the supplier base. Available tools are data collection and analysis, and management presentation.

Step 5. *Assess supplier performance.* Based on actual supplier performance, begin the process of the ongoing evaluation and assessment of the performance of the remaining suppliers. This typically involves evaluations of supplier quality systems now in place, supplier capacity and capability, and fitness for purpose of the commodity being supplied.

Supplier assessment comprises three separate but interrelated assessments, undertaken by the cross-functional team. These assessments ensure conformance to quality and performance standards, and establish a baseline for the improvement process.

Assessment 1. *Supplier quality systems assessment.* This assessment evaluates the quality systems the supplier currently has in place. It requires a visit to the supplier site by an evaluation team or by a third party who will certify the quality system as acceptable. This assessment should evaluate the supplier's:

- Focus on customers' needs
- Management commitment to total quality management
- Defined, documented, and fully implemented quality system
- Employee empowerment in terms of monitoring their own work for defect
- Use of fact-based, root cause analysis to investigate and correct quality problems
- Programs to encourage and evaluate quality improvement with their suppliers
- Commitment to continuous improvement in all phases of its operation

Cost considerations may favor reliance on a third-party supplier certification instead of an evaluation by employees of the purchaser. Where this is done, it is important that the end-user organization clearly understand what this certification does and does not include. The standards for supplier certification most often referred to are

- The ISO 9000 standards (ISO 9001, 9002, 9003), designed as models and guidelines of the minimum requirements for an effective quality system (see Chapter 16, Using International Standards to Ensure Organization Compliance).
- The ISO 14000 standards, designed as models and guidelines of the minimum requirements for an effective environmental system
- Quality System Requirements QS-9000, developed by the Chrysler/Ford/General Motors Supplier Quality Requirements Task Force. It is based on ISO 9000 standards, to which may be added automotive interpretations and further requirements (for example, continuous improvement and advanced product quality planning).
- Quality System Requirements AS-9100, developed by the International Aerospace Quality Group (IAQG). It is also based on ISO 9000 standards, to which may be added aerospace requirements necessary to address civil and military aviation and space needs (for example, regulatory agency roles and responsibilities and aerospace material traceability and accountability systems.)
- The Malcolm Baldrige Assessment, designed for applicants of the U.S. Malcolm Baldrige National Quality Award. It evaluates the process systems in place and the underlying organization and cultural issues of leadership, degree of empowerment,

and utilization of information and information technology in place to facilitate quality planning, quality control, and quality improvement (see Chapter 17, Using National Awards for Excellence to Drive and Monitor Performance).

Assessment 2. *Supplier business management.* This assessment evaluates the supplier's capability as an ongoing business entity to meet the end user's current and future business needs. This includes assessment of the supplier's current and future financial and operating performance. This assessment should evaluate the supplier with respect to:

- Research and development initiatives to ensure consistency with its customers' needs and future plans
- Cost structure to ensure financial health
- Production capacity to ensure ongoing ability to produce and distribute the required goods and services
- Information technology to evaluate willingness and capability to initiate information-sharing initiatives such as electronic data interface (EDI) and electronic funds transfer (EFT)

The assessment includes measurement of such indicators as debt-to-equity ratio, percent of profit reinvested in the business, inventory-to-sales ratio, employee turnover statistics, and capacity utilization.

Assessment 3. *Supplier process capability and product fitness for purpose.* This assessment evaluates the fitness for purpose of the product or service being supplied, as well as the supplier's process capability to consistently manufacture goods to stated needs. The focus is on quality, delivery, and service. Specifically, this assessment should evaluate:

- Conformance to customer requirements
- Process capability (Cpk or process Sigma)
- Key performance indicators

The assessment includes measurements of such indicators as the following:

- Percent of nonconforming products shipped
- Cycle times of key processes
- Customer satisfaction
- Identified and measured cost of poor quality

Available tools are supplier site visits, data collection and analysis, and third-party evaluations.

Improvement for Supplier Relations

The improvement phase includes:

- The management, measurement, and continuous improvement of the sourcing process
- The expansion of control and initiation of continuous improvement within the supply chain itself to ensure value creation

These improvement initiatives build on the foundations of quality, total cost of ownership, and supply chain management already established in the planning and control phases. Fundamental to improvement in the performance of the entire supply chain is that trust has been established between all parties in the entire supply chain, from suppliers through end users. The objective of the improvement phase is to develop a supply chain that acts as a single entity, develops common goals, formulates real-time decision making, measures performance through a single set of key performance indicators, and is collectively responsive to the needs of the end user.

With trust as the foundation, supply chain management and optimization can proceed. This sense of trust cannot be achieved by a single act of signing a long-term contract or by prominently displaying a banner indicating a commitment to quality. It must be demonstrated by behaviors and actions over an extended period. As the climate of cooperation grows, the degree of trust between all supply chain participants becomes deeper, and opportunities for value creation, joint problem solving, and innovation are identified and realized.

Five tiers of progression. In the control phase, the end user and suppliers have identified and flow-charted the entire supply chain. The continuous improvement phase generally progresses through five levels of cooperation: (1) joint team formation, (2) cost reduction, (3) value enhancement, (4) information sharing, and (5) resource sharing.

Level 1. *Joint team formation.* The improvement phase begins with the establishment of a joint (end user/supplier) team. Although the team could have several objectives, the initial focus should be on:

- Alignment of goals
- Analysis of the supply chain business process
- Identification and remediation of chronic problems

Goal alignment ensures that each link in the supply chain develops goals and objectives, and proposes initiatives whose focus is the needs of the end user. Furthermore, goal alignment and the activities associated with it are a natural first step in developing the synergies and trust required for further supply chain development.

In conducting the business process analysis of the supply chain, the team begins to identify the elements of the chain and collect data to measure its performance. This data collection should focus on the areas of the supply chain that have a high probability of generating quality problems, such as excessive cycle time, rework, and scrap, or which are likely to create customer dissatisfaction.

Supply chain business process analysis represents the initial steps of identifying the chain (typically using flow charting) and collecting data that describe the performance of this supply chain. This data-collection phase should focus on the areas of high probability of quality problems, such as cycle time, rework, scrap, or customer dissatisfaction.

Chronic problem identification and remediation offer a preliminary opportunity to work collaboratively on problem solving in this joint team environment. This offers a classic opportunity for a quality improvement team with membership from the various members of the supply chain. The team's efforts will likely result in near-term process improvement and enhanced customer satisfaction, and offer an opportunity for collaboration and trust to be nurtured within the chain itself.

Level 2. *Cost reduction.* Level 1 initiatives help create a culture of trust and collaboration between supplier and end user, especially as the result of the work of joint problem-solving teams. The teams were established to identify and gather the "low-hanging fruit," that is, reduce the occurrence of chronic problems in their joint business processes, which are relatively easy to solve, once identified. Level 2 requires an approach to process improvement in

more depth, often involving suppliers to the supplier or customers of the end users. Proactive managing of the supply chain begins at this point to replace the bilateral relationship between end user and supplier.

A COPQ study of the supply chain provides powerful guidance for organizations engaged in cost reduction. The costs are usually sorted into three categories:

- External failure costs (i.e., warranty, customer dissatisfaction, recall costs)
- Internal failure costs (i.e., scrap, rework, rejected raw material, downtime costs)
- Appraisal costs (i.e., inspection, testing, verification costs)

For significant concentrations of COPQ revealed in the supply chain, joint teams are established to reduce those costs, project by project. As activities advance to a higher level, the activities of the lower levels continue. For example, as the chain moves into Level 2 and begins measuring and managing cost reduction opportunities, the tools and initiatives of Level 1 continue. This accumulating effect continues throughout the five levels.

Level 3. *Value enhancement.* As the teams begin reducing COPQ, the supply chain itself begins to function as a single business process, rather than as a set of separate ones. At this point, the team needs to flow-chart the activity of the supplier chain and evaluate the value added by each link in the chain. Two questions addressed at this stage are: Does this step add value? and What would happen if we were to skip this step? The nonvalue-added steps are identified and eliminated.

Level 4. *Information exchange.* At this point in the supply chain improvement evolution, what was traditionally treated as confidential information is being routinely shared and more widely distributed throughout the chain. Furthermore, electronic commerce tools such as EDI, Internet and intranet applications, and groupware applications such as Lotus Notes are facilitating the transfer of information, the collaboration of ideas, and real-time decision making.

Level 5. *Resource sharing.* In the latter stages of supply chain management and improvement, the "walls" that traditionally separated departments, divisions, and companies have been eliminated. Fewer are working in corporate silos; the supply chain is beginning to function as a single process—involving personnel from several different suppliers within the chain, from the customer's organization, and the end user. Personnel within the chain are routinely collaborating on ideas and improvement opportunities, and performance is continuously measured. Personnel from the various suppliers within the supply chain are often colocated with their customers to further facilitate this collaboration.

At the highest level of supply chain management, the extent of data, resource, and risk sharing has increased to a dramatic level. Not only are personnel colocated with their customers, but technology plans and risk-taking initiatives and investments are shared throughout the supply chain, and benefits and losses are jointly apportioned. A seamless supply chain process begins to emerge, generating value for customers, as well as suppliers.

Implementing and Using Supplier Scorecards

Effective supplier scorecards can help the producer improve the speed and reduce the cost of his supply chain. Key to effectiveness is the choice of appropriate criteria against which to measure your suppliers and metrics that directly reflect performance against these criteria. Nearly universal criteria are quality history, total cost, and timeliness of delivery, but other criteria may be important to add, depending on a producer's particular needs, for example:

- Design and technical capability
- Proximity to producing facility

- Responsiveness
- Past problem resolution effectiveness
- Audit results
- Price increase/reduction history
- Financial stability

Depending on what stage of supplier management the producer is at—planning, control, or improvement—different sets of criteria may be more or less applicable.

Often, a criteria-based selection matrix is used to rank each supplier (or potential supplier) of a particular part, component, service, etc. (see Figure 30.3 for an example). The producer must then set standards for what constitutes an acceptable score. A stoplight analogy is often used to represent supplier status, such as:

- 85–100, green: No action, continuing with preferred supplier
- 75–84, yellow: Supplier must develop and submit a timely improvement plan.
- 74 or below, red: Supplier must submit an improvement plan and will not be considered for future bids until score has improved to an acceptable level. If no acceptable plan is submitted or progress is not documented, current supplier work may be resourced.

Appropriate metrics must be designed if they do not already exist. The metric must reflect measurable characteristics of the criterion and be easily applied to the scoring system in use by the producer. For example, a metric for quality history might be as shown in Table 30.4.

It is recommended that the rating system not be overcomplicated. Keep the scorecard criteria to only those things that are meaningful indicators of the supplier's value to the producer (usually five or six criteria). If a scorecard system is made too difficult for supplier quality or purchasing personnel to use, its value to the organization will be reduced.

The criteria, once established, must be evenly applied. Some supplier rating systems give latitude to the supplier quality engineer whether or not to issue a formal corrective action request to the supplier, which would negatively affect the supplier's score. This

ABC company-supplier scorecard

Product family supplied: Widget — Updated: 10/12/09

		Suppliers					
Criteria	**Weight**	**A**	**B**	**C**	**D**	**E**	**F**
Quality history	3	9	8	10	7	9	7
Total cost	2	8	10	9	10	9	9
Timeliness of delivery	2	8	8	7	9	9	7
Financial stability	1	9	8	5	8	9	10
Audit results	2	6	7	7	6	8	7
Total score		80	82	81	79	88	77

Figure 30.3 Supplier scorecard.

Number of SCARs	Supplier Rank
0	10
1–2	9
3–4	8
5–6	7
6–7	6
7–8	5
8–9	4
10–11	3
12–13	2
14 or more	1

TABLE 30.4 Eighteen-Month Rolling Number of Supplier Corrective Action Requests (Metrics)

latitude leads to arbitrary decisions and erroneous measures of the supplier's performance, thereby lessening the value of the scorecard.

Auditing Suppliers to Support the Scorecard

A regular auditing program to monitor supplier continuous improvement progress is important to add validity to the supplier scorecard. Particularly for suppliers of key or critical components, audits should be conducted at specified intervals of no longer than biannually. If your organization has supplier quality engineers (SQEs) who are responsible for a specific set of suppliers, it is often wise to have others who are not as familiar with those particular suppliers participate in the audits along with the responsible SQEs to minimize possible biases and bring a fresh set of eyes to the evaluation. If resources are an issue, the producer should consider engaging third parties in the auditing effort to get that unbiased view.

The checklist used for a supplier audit should include all the areas of the supplier organization that could affect the quality of supplies and components, including:

- The strategic planning process and its effectiveness
- The quality management system, its appropriateness and effectiveness
- The efficiency and effectiveness of the processes used to measure, control, and improve product and process quality
- The supplier culture (i.e., is it one that supports continuous improvement and process excellence?)
- Human capital management (does the supplier practice employee involvement and the principles of self-control?)
- The quality of products and services provided by this supplier (complaints, rejections, corrective action requests, etc.)

- The efficiency and effectiveness of the supplier's own supply chain, including supplier scorecards, audits, and quality records
- The efficiency and effectiveness of the supplier's product and service creation process
- Supplier delivery performance
- Measurement systems that obtain appropriate measures based on user needs and relate to key business drivers and strategies
- The supplier's understanding of customer needs and measures of how well those needs are being met
- The supplier's analysis of competitors' strengths and weaknesses and how they compare
- The effectiveness of supplier benchmarking activities that help understand best-in-class performance
- The supplier's understanding of the cultural behaviors and norms that are needed to create a customer-oriented culture

Other supplier attributes may be uniquely important to your producer organization and should be added as appropriate.

The scoring of the supplier audit should be made as objective as possible. This can best be accomplished by setting clear "if, then" rules to guide the auditor's decisions. For example, perhaps the scoring is done on a 1 through 10 scale and a rule might be "if the supplier's delivery performance is 95 percent or greater on time, then assign a score of 10. If 90 percent or more but less than 95 percent, then assign a score of 9," and so on. The key is to take as much subjectivity out of the scoring decision by establishing clear rules for each category. The producer can also weight the importance of each element in the audit by assigning a greater number of points possible for the key audit elements.

The producer should also establish acceptance limits for the supplier audits. If a supplier falls below the acceptable level on any audit element, then an improvement plan addressing each deficient area should be required. The savvy producer will lend assistance to the supplier to help them improve and meet the producer's goals for its suppliers. The resources for that assistance can come from within the producer's organization or from third parties skilled in supplier development and improvement.

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