Managing the Extended Enterprise

by Paul D. Ericksen and Rajan Suri

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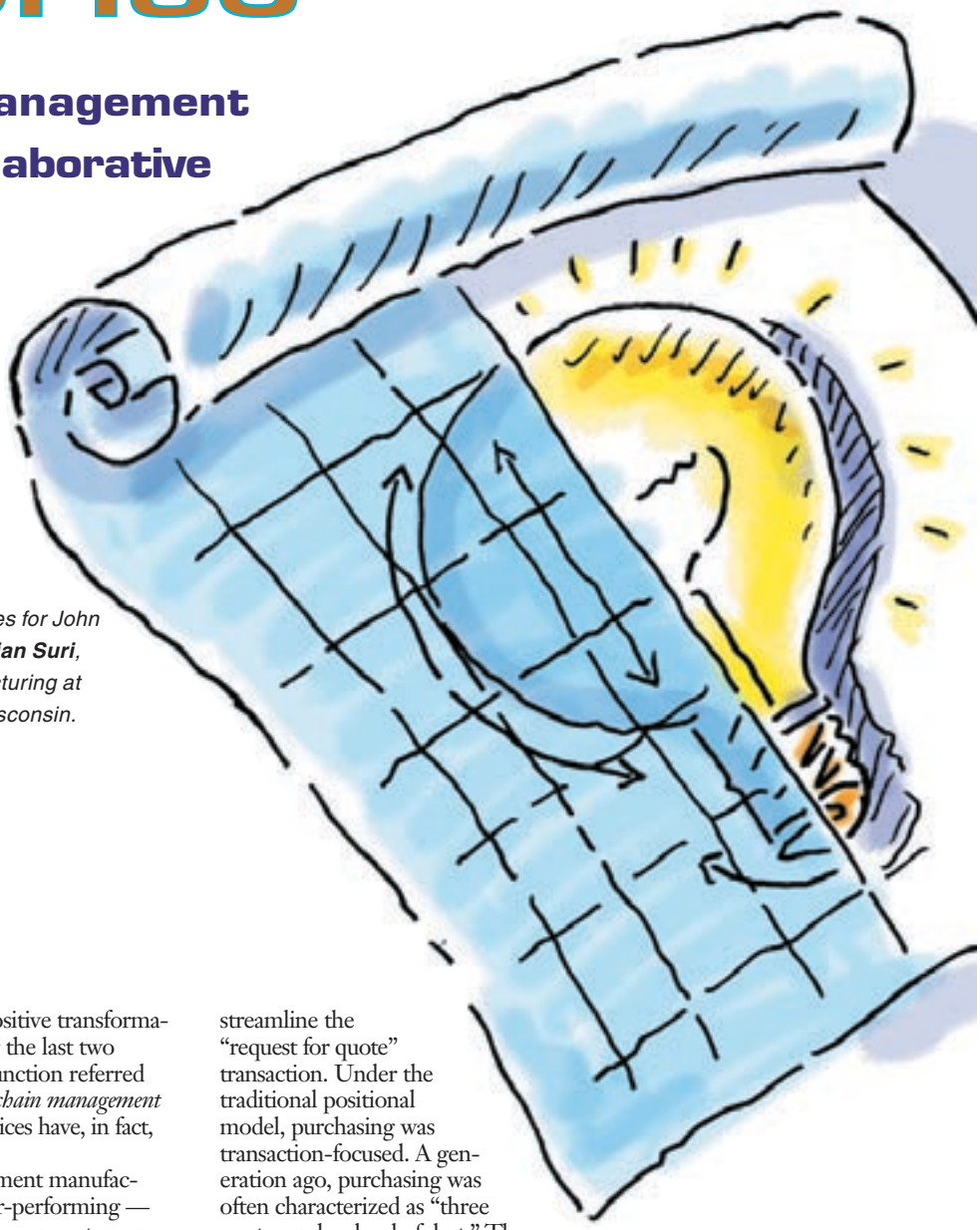
Time-based supply management is a proactive and collaborative strategy that can be used throughout the supply chain from blueprint to end product.



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Much has been made of the positive transformations in supply management that have occurred over the last two decades. Today, you seldom hear the procurement function referred to as *purchasing*. Rather, *supply management* or *supply chain management* are the favored terms. Advances in procurement practices have, in fact, been significant. For instance:

Supply base optimization has allowed original equipment manufacturers (OEMs) to focus resources on fewer — higher-performing — suppliers. This has resulted in a better alignment between customer needs and supplier capabilities.

Total acquisition cost is now the basis for assigning business. Quoted price is just one factor in sourcing decisions. This has led to better OEM understanding of total supplier bottomline impact.

Supplier integration and early supplier involvement have broken down the walls between supplier and customer technical resources to greatly streamline and enhance OEM product development.

Recently, the impact of e-commerce on procurement has received significant attention. Based on initial results, e-commerce is characterized as having the potential to revolutionize the profession. Lost in the excitement, however, is the underlying reality that e-commerce initiatives mainly impact procurement *transactions*. For instance, *online auctions* streamline the "request for quote" transaction. Under the traditional positional model, purchasing was transaction-focused. A generation ago, purchasing was often characterized as "three quotes and a cloud of dust." The terms "supply management" and "supply chain management" imply much more, however, than transactions. They imply integration of strategic suppliers into the very fabric of an OEM customer's product development and order fulfillment processes, and all of the spadework required to support that.

Modern supply management strategies are based on close collaboration between OEM customers and their suppliers. The risk surrounding all of the current e-commerce hoopla is that high-ranking OEM executives may get the impression that procurement does revolve around transactions. And arm's-length transactions, at that. One might say that "three keystrokes and a cloud of dust" is superseding "three quotes and a cloud of dust." Worse yet, senior management may have the further

misconception that streamlining transactions is a silver bullet for achieving effective supplier continuous improvement. Perpetuation of this premise would be a major blow to the supply management profession. It ignores the benefits achieved through extended enterprise supply management. "Three keystrokes and a cloud of dust" would not be a step forward, but a step backward.

So what does this all mean? Should the efficiency improvements offered by e-commerce be ignored? No, absolutely not. But thoughts regarding the potential benefits of e-commerce need to be tempered. One must not ignore that in order to support procurement transactions, someone, at some point, must *manufacture* something. And while increasing efficiency in transactions can be a good thing, significantly greater potential for waste elimination exists in increasing manufacturing effectiveness.

Time-based supply management is a proven new strategy that can be used by OEMs to recognize and eliminate supply base waste. Its implementation is based on the leadtime reduction principles of *quick response manufacturing* described below. Time-based supply management is a proactive, collaborative approach to obtaining continuous supplier improvement. It leads to sustainable cost reduction as well as other supplier performance improvements and enhances working relationships between OEMs and their strategic suppliers.

Points of Interest

At a glance, here are the main points covered in this article. By reading it, you will learn:

- The meaning of the concepts: extended enterprise supply management, time-based supply management, and quick response manufacturing
- How these concepts measure metrics such as quality, delivery, price, and value
- How specific organizations have implemented these models with success

Extended Enterprise Supply Management

In 1999, Chrysler Corporation (now Daimler-Chrysler) was granted a trademark for the term *extended enterprise*. This formalized a concept that has received considerable play, as OEMs became less vertically integrated and more reliant on suppliers for their own market-place image and financial success. Chrysler's (abbreviated) definition of extended enterprise is:

Extending business relationships by providing process management consultation and workshops to … suppliers and supplier tiers in order to reduce cycle time, to minimize system cost, and to improve the quality of the goods or services provided by the suppliers.

Mike Gushock

John Deere Horicon Works, the world's largest manufacturer of premium ride-on lawn mowers located in Horicon, Wisconsin, has enhanced Chrysler's definition of extended enterprise supply management. Horicon's goal is to provide strategic suppliers the same level of technical and resource support they would receive if they were internal Horicon departments. Under this approach, strategic suppliers are no longer given tactical performance goals and left to their own means to achieve them. Instead, John Deere Horicon Works collaborates with its strategic suppliers, assisting them in their efforts toward continuous improvement.

What type of supplier should be regarded as *strategic*? There are many definitions of the term "strategic," as it applies to supply management. This definition, however, is nontraditional in its fundamental premise since it's not related to the impact of the supplier's product on the buying decision of the end-use customer that purchases the OEM's product. A strategic supplier is simply a current supplier that would be difficult to replace, due to any number of business-related reasons such as:

- There are few or no alternative source suppliers.
- Alternative source suppliers may be aligned with the competition.
- Changing suppliers would be unduly expensive.
- The current supplier is too interwoven into the enterprise to efficiently replace.
- The organization has partial ownership in the supplier.
- There can be many more reasons to classify a supplier as strategic.

Applying extended enterprise supply management to strategic suppliers is not as straightforward as one might think, especially in John Deere Horicon Works' sense. Not only must traditional supply management paradigms be broken, supply management professionals have found that they lack the basic tools needed to effectively manage extended enterprise suppliers. Specifically, what metric(s) can an OEM customer use to determine which of its extended enterprise suppliers is in need of assistance?

Traditional Metrics Revisited

Benchmark a cross-section of industry-leading OEMs and you will likely find that each employs a trinity of fundamental supplier performance metrics: (1) quality, (2) on-time delivery, and (3) price. These three metrics are not sufficient to support extended enterprise supply management paradigms. To illustrate this, each is examined more closely as it relates to understanding supplier operations.

Quality. As applied, this metric is not actually a measure of *supplier process yield*. More accurately, it should be termed *as-delivered quality*, and even this name is somewhat misleading since defective purchased parts — regardless of internal OEM measures — routinely find their way into OEM finished product. Suppliers that have not consistently shipped quality products to their customers have dropped out of most OEM supply chains, leaving for the most part suppliers that achieve

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acceptable as-delivered quality ratings. However, since the traditional quality metric can be achieved through intensive supplier inspection and sort, high as-delivered quality ratings cannot be used as an indication that a supplier has robust, well-targeted, and in-control processes. Suppliers with high as-delivered quality ratings may actually be in need of extended enterprise supplier type assistance.

Delivery. Suppliers that deliver parts to customers during customer-designated receipt intervals achieve high on-time delivery ratings. Again, suppliers that have not consistently delivered parts to their customers as needed generally no longer populate OEM supply chains. On the other hand, suppliers can achieve high on-time delivery ratings by building product ahead of order and shipping from finished goods inventory. Relying on stockpiles of finished goods inventory is not generally regarded as effective order fulfillment. Suppliers with high on-time delivery ratings may also be in need of extended enterprise supplier type assistance.

John Deere Horicon Works has improved its suppliers' manufacturing flow and overall production as well as decreased cycle time through the implementation of these proven techniques.

Photos courtesy of John Deere Horicon Works

Price. Suppliers generally don't obtain business if their prices aren't competitive. But what does price-competitiveness indicate to an OEM about a supplier? It cannot be assumed that price-competitive suppliers are low-cost producers. Suppliers can achieve low pricing by cutting margins, discarding support staff, and/or delaying or forgoing capital investment. Suppliers adopting this *cut-and-burn* approach to winning business certainly are in need of extended enterprise supplier type assistance, but the current supply management price metric will not reveal this.

What about detailed assessments of suppliers — can they fill the gap? This approach is examined below.

Supplier Assessments

OEMs conduct comprehensive supplier assessments to facilitate supplier operational improvement. But do these assessments support the extended enterprise supply management paradigm in which both supplier performance and how that performance is achieved are important? In conducting a comprehensive assessment, an OEM typically sends to a supplier a cross-functional team of experts that take days or weeks to audit supplier operations. This approach is extremely resource-intensive, both for the OEM customer and the supplier. For that reason, assessments are not normally routinely done, rather they occur in response to supplier performance shortfall. This leaves off the OEM's "assessment radar screen" suppliers that are highly rated performers under the traditional metrics. Yet, as has been seen, these suppliers may need assistance in improving their operations. Let's draw a parallel to your personal life.

Consider going to your doctor for a physical exam. Assume that you feel fine but have reached the point in your life where routine annual "physicals" are recommended. You tend to go into the exam under an assumption that everything is fine. There are two ways your doctor can look at it.

On the one hand, the doctor can assume that nothing is "okay," and put you through a comprehensive battery of tests. Under this strategy, it's assumed that something might be wrong somewhere, and for that reason, everything must be checked out. This approach is costly and time-consuming, for both the doctor and the patient. In fact, due to cost, it's difficult to find health insurance companies that will pay for routine comprehensive physicals. More often than not, physicals of this kind don't happen unless you first exhibit some symptom.

Another approach is for your doctor to measure high-level indicators of health such as temperature, blood pressure, and heart rate. Since taking these measurements involves minimal time and cost, they can be taken on a more routine basis. Based on readings from these "red-flag" physical indicators, more detailed examination can be pursued if something appears "out-of-whack."

Rather than comprehensive assessments that require significant resources and are often reactive, extended enterprise supply management would be more appropriately supported by high-level, nonthreatening operational metrics that could be used as "red-flag" indicators of a supplier's operations. These metrics are similar to the temperature, blood pressure, and heart rate readings your doctor would take, and could be routinely monitored. They would indicate to an OEM whether or not a need existed to take a closer look at the operations of a strategic supplier, regardless of its current tactical performance. One such metric will now be introduced. A key property of this metric is that it alerts an OEM to take another look at a supplier that, as rated by its traditional performance metrics, would be considered a high performer.

A Modern Metric for a Modern Profession

It's important that suppliers demonstrate the performance per the traditional supply management metrics necessary to support their OEM customers, but not if their strategies for achieving this performance perpetuate wasteful practices such as inspection and stockpiling inventory. If suppliers cannot meet their performance bogies through modern manufacturing strategies, their as-delivered quality, on-time delivery, and pricing may not be sustainable. In order to reduce the risk of future supplier non-performance, a new metric is needed to trigger proactive OEM involvement in supplier continuous improvement. A metric that satisfies this need and that has already proven itself in

John Deere Horicon Works' extended enterprise efforts is manufacturing cycle time (MCT): the typical amount of calendar time from when a manufacturing order is created through the critical path until the first, single piece of that order is delivered to the customer.

MCT measures the time of the longest path that the product or its components take as they flow through a supplier's operations all the way to their customer. It's not just a measure of shop-floor operations; office operations and logistics time are included. In its applications of this metric to supplier continuous improvement, John Deere Horicon Works has found that MCT has several desirable properties:

- MCT is a high-level indicator of whether a supplier's manufacturing operations are efficient. As such, it can be a primary indicator of both supplier order fulfillment flexibility and future viability. Quoted leadtimes often have no relationship to supplier MCT values, since the quoted leadtimes can be made much shorter than the MCT via stockpiling finished goods or partially completed components. Such inventory is obviously a waste of working capital. Worse, it can result in even greater waste if engineering changes require material to be scrapped or reworked, or demand falls significantly below what was forecast and the inventory cannot be used for an extended period.
- MCT is a nonthreatening metric. Suppliers that might balk at providing sensitive cost and operational information will normally not do so with MCTs.
- MCT is a convincing metric for motivating suppliers to take action. It's usually easy to make the case to supplier management that long MCTs reflect lower overall operational effectiveness.
- MCT reduction is easy to understand as a measure of operational improvement.

The strongest asset of MCT, however, is that its use as a supply management metric supports and drives continuous improvement of the three traditional supply management metrics. As suppliers work to reduce their MCTs, their as-delivered quality, on-time delivery, and price performance also improve. To illustrate this, the synergy created by these four metrics is examined in detail below.

MCT and quality. Coupled with the MCT value, a supplier's as-delivered quality rating now becomes an illuminating metric of supplier processing yield. For instance, a supplier with a high as-delivered quality rating and a short MCT likely has well-targeted and in-control manufacturing processes that consistently produce a high yield of parts to specification (that is, with a short MCT there is no time for multiple inspect and sort operations). On the other hand, high as-delivered quality ratings that are associated with long MCTs indicate a higher probability of lower-yielding manufacturing processes. Suppliers fitting this profile may be achieving their high as-delivered quality rating through inspection and sorting. Knowledge of both metrics paints a more complete picture about supplier processing. Together, they become an indicator of supplier quality related risk.

MCT and on-time delivery. When combined with MCT, a supplier's on-time delivery performance reveals something about its manufacturing effectiveness. High on-time delivery performance in conjunction with a short MCT indicates a lean supplier with predictable scheduling and product flow. Suppliers with long MCTs yet high on-time delivery performance probably achieve their ratings by shipping from stocks of finished goods inventory. With higher MCTs, there's a greater reliance on complex scheduling and frequent rescheduling as demand changes. There is also more opportunity of operational "glitches" introducing processing delays. Additionally, parts in storage can become obsolete and/or degraded. Thus, these two metrics together become an indicator of the risk associated with a supplier's inability to respond to change in market demand.

MCT and price. Competitive pricing and short MCTs indicate minimal waste and a higher probability of a financially healthy supplier. Competitive pricing associated with long MCTs raises an immediate red flag about a supplier's viability. Since long MCTs are probably associated with excessive non-value-added activities, pricing obtained in this way is generally artificial and not sustainable. Long-term viability may also become an issue.

The use of MCT elevates traditional "arm's-length" procurement to extended enterprise supply management, as explained next.

Time-Based Supply Management

Time-based supply management is individualized, collaborative management of suppliers' continuous improvement based on their MCTs. The longer a supplier's MCTs, the more potential for improving its operational performance through MCT reduction.

Under time-based supply management, OEM customers are interested not only in supplier performance but also in how suppliers achieve their performance. For that reason, it's necessary to base time-based supply management decisions on primary indicators of supplier operations such as MCT. Secondary supplier operational metrics such as on-time delivery, as-delivered quality, and price alone have little value in proactive OEM management of supplier continuous improvement.

Generally speaking, OEMs should have higher continuous improvement expectations of suppliers with longer MCTs, regardless of those suppliers' current tactical performance. Also, because of the greater potential for improved performance, OEMs should focus their supplier assistance resources on suppliers with longer MCTs, with a primary goal being to assist those suppliers in reducing their MCTs. Having identified such suppliers, how does an OEM proceed? Another proven approach in John Deere Horicon Works' dealings with suppliers is described below.

Quick Response Manufacturing

OEMs with effective manufacturing operations are increasingly common today, and for a good reason — it's becoming a competitive requirement. Despite internal progress in this regard, OEMs have seldom attempted the next logical step — extending their internal manufacturing knowledge and expertise to their external supply base. Parts and services purchased from suppliers comprise roughly 60 to 80 percent of OEM product cost. Hence, OEMs have tremendous incentive to bring internal resources to their suppliers. This, indeed, is the fundamental premise of extended enterprise supply management.

In instances where OEMs have tried exporting internal knowledge and expertise to their suppliers, the results have been spotty. Suppliers

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> *Director, Center for Quick Response Manufacturing, University of Wisconsin–Madison*

Table I: Traditional Management Policies vs. QRM Approach

Traditional Management Policy	What QRM Prescribes
Aim for 100 percent capacity utilization to maximize return on investment in resources.	Strategically plan for spare capacity to enable quick response to customer orders.
Focus on maximizing efficiency of departments (e.g., use large batch sizes).	Use batch sizing and other policies that focus on minimizing MCTs.
Use MRP to set leadtimes and scheduling systems to manage and control jobs.	Create cells first, then use rapid modeling tools to set MCTs within the cells.
Employ labor with limited specialized skills to minimize payroll expense.	Use highly skilled, cross-trained labor to minimize wait time and maximize quality.

to OEMs typically fit the profile of small- to medium-sized manufacturers. OEMs encounter difficulty when attempting to transfer modern manufacturing strategies to this profile of supplier. This is because most small- to medium-sized manufacturers don't have the necessary infrastructure to become efficient in the same way that their larger OEM customers did. Why? Historically, this type of supplier has met OEM customer continuous improvement expectations by reducing overhead rather than by eliminating waste. This happens largely because suppliers don't have the luxury of large technical staffs to dedicate to special projects. Instead, the management personnel of most small-to-medium suppliers spend most of their time simply "keeping the railroad running."

Consequently, suppliers often find that the techniques and strategies used by their OEM customers either are too complex, apply only to large enterprises having high-volume production and low product mix, require too many resources, take too much time, or cost too much. John Deere Horicon Works has bridged this gap with a process called quick response manufacturing (QRM) (see "Additional Resources"). At Horicon, QRM is the preferred approach to implementing time-based supply management.

QRM looks closely at both office and shop-floor processes with a strategy of eliminating waste through leadtime reduction. It's simple and straightforward and doesn't require large staffs of highly trained technical experts. QRM often can be implemented at minimal cost. With QRM, it's not necessary to have repetitive manufacturing or stable demand. QRM allows focus on individual, customized production, while still maintaining low inventory and fast response. QRM embodies the mind-set of pursuing leadtime reduction, along with detailed management principles, manufacturing methods, technical analysis and tools, and a step-by-step methodology to achieve desired improvements.

Although the QRM approach is relatively straightforward, the QRM mind-set requires a substantial shift from traditional manufacturing management policies (see Table I). Major steps in implementing QRM methodology include facilitating management and employee understanding of why a mind-shift is necessary, and then providing the organization with concrete steps and hands-on tools. Another unique aspect of QRM is the use of simple system dynamics insights to assist in the understanding and implementation of these strategies. Simple tools based on system dynamics (see "Additional Resources") illustrate the detrimental impact of existing policies on MCTs, and help to justify the use of a QRM strategy.

The Next Industrial Revolution?

Time-based supply management is a natural extension of extended enterprise supply management. MCT is a powerful new supply management metric that when used in conjunction with traditional supply management metrics reveals insight into supplier operations. MCT facilitates collaborative supplier continuous improvement by bridging the gap between supplier performance and OEM understanding of how that performance is achieved. It's a straightforward and relatively easy metric to obtain. Supply management professionals no longer have to rely on applying broad-brush supply management strategies to meet their financial goals. Managing individual suppliers at an operational level is now feasible. Quick response manufacturing, with its focus on MCT reduction, is the preferred approach to implementing time-based supply management with suppliers.

The practice of time-based supply management will, however, require paradigm changes on the part of both OEMs and their

Table II: Impact of Time-Based Supply Management at John Deere Horicon Works

Commodity	MCT		% MCT Reduction	% On-Time Delivery		As-Delivered PPM		% Cost Reduction
	Before	After		Before	After	Before	After	
Blades	15 days	2 days	87	74	97	4,500	300	11
Knives	104 days	15 days	86	40	88	12,000	1,500	22
Hydraulic Valves	141 days	10 days	93	40	98	50,000	1,500	14
Hydraulic Motors	42 days	18 days	57	40	97	15,000	500	13
Wiring Harnesses	32 days	2 days	94	43	99	3,000	500	20
Seat Assemblies	25 days	5 days	80	40	95	50,000	500	16
Machined Parts	22 days	10 days	56	99	99	300	300	12
Circuit Boards	25 days	16 days	36	99	100	3,164	14	17

MCT = Manufacturing Cycle Time
PPM = Quality in Part Per Million Defects

strategic suppliers. In Table III, time-based supply management philosophies are compared with traditional supply management thought. While these mind-set shifts will take some effort, the benefits of making the shifts will be manifold, both for the profession and for enterprises. Not only will time-based supply management elevate the profession in terms of its strategy and tactics but it will also make extended enterprise supply management possible in practice, not just concept. Although not a "quick fix," over time, extended enterprise collaborative relationships offer the potential for a higher-performing industrial model. Supply management support of seamless operations between OEMs and their strategic suppliers might well provide the basis for the next industrial revolution.

Additional Resources

A detailed case study on the application of time-based supply management to one supplier can be found in "Quick Response Manufacturing Drives Supplier Development at John Deere," by P. Golden, *IIE Solutions*, July 1999.

For the principles of QRM, see *Quick Response Manufacturing: A Companywide Approach to Reducing Lead Times*, by R. Suri, Productivity Press, 1998.

Tools for implementing time-based supply management and QRM are available from Network Dynamics Inc., www.networkdyn.com.

Current activities on QRM can be found at the Center for Quick Response Manufacturing home page, www.qrmcenter.org. PT

Table III: Comparison of Time-Based Supply Management with Traditional Approaches

Traditional Supply Management	Time-Based Supply Management
Setting supplier performance standards and giving suppliers feedback on performance gaps is sufficient OEM supplier development involvement.	OEM willingness to provide its suppliers the same level of technical and resource support they would get if they were departments within the OEM's factory.
Changing suppliers to chase lower pricing is an efficient, long-term supply management strategy.	High value placed on supplier support, especially in product development and order fulfillment. It may be more cost-effective in the long run for an OEM to maintain supply base stability by developing strategic suppliers.
Suppliers bidding online to retain current business.	OEMs assisting suppliers to lower pricing on current business through supplier development.
OEM broad-brush supply base price reduction mandates.	Individually tailored price reduction expectations based on supplier specifics. The less effective a supplier's current operation, the more the expectation for price reduction.
Suppliers are experts in the manufacture of their products. OEMs can contribute little toward streamlining supplier operations.	OEMs can help suppliers to reduce cost by introducing them to and assisting them to implement modern manufacturing strategies.
Challenging suppliers with mandated price reductions helps suppliers in the long run by making them more efficient.	Prices go down when costs go down. Imposed price reductions threaten suppliers' viability if they are unable to reduce costs.
OEMs have control over product cost and quality.	OEM product cost and quality is dependent on supplier processes and manufacturing effectiveness.
Supplier cost is dependent on machine cycle time(s).	Supplier cost is dependent on overall MCTs.
Suppliers locating personnel onsite at OEM customers to resolve delivery and quality problems.	OEMs locating personnel onsite at suppliers to ensure tactical supplier performance through waste elimination.
Supply management metrics of supplier impact on OEM operations, such as percentage of on-time delivery, as-delivered quality, and price, are the best metrics for OEMs to use in managing their suppliers.	Supply management metrics that reflect actual supplier operations — such as MCT — are best for OEMs to use in managing their suppliers.

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