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Sourcing in the global aerospace supply chain using online reverse auctions

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Abstract

This article discusses the use of online reverse auctions to source engineered components in global aerospace supply chains using online reverse auctions and examines the specific case where a long-established U.S. economic cluster supporting large tier-one aerospace companies must compete against globally distributed sources of supply favored by their customers due to unit price savings, principally the result of lower wages. The article also examines if global sourcing practices based on power-based bargaining is an intelligent or effective solution to market pressure demanding lower prices, or whether collaborative problem solving and the creation of knowledge-sharing networks offers greater potential for cost savings and improved long-term supply chain competitiveness. Key factors that contributed to the recent failure of global sourcing initiatives using online reverse auctions are presented. Findings can be generalized to other industries that use online reverse auctions for globally sourcing engineered components that rely on networks of supporting service suppliers to create finished goods.

Keywords: Global sourcing; Supply chain; Reverse auctions; Total cost; Unit price

1. Introduction

Globalization over the last 10–15 years has expanded trading relationships between U.S.-based companies and nascent businesses in developing nations. For large, multi-billion-dollar, U.S.-based aerospace businesses, globalization represents opportunities to sell products to new customers and establish new sources of supply in countries with lower wages. Key drivers for global sourcing in the aerospace industry include:

1. Obtaining lower unit prices on recurring production materials,
2. Increasing market share, country- or region-specific, or win key sales opportunities.

The first item is related to the basic requirement for increasing profits and meeting marketplace demands for lower prices. The second item is partly related to a unique aspect of U.S. aerospace industry sales in the global marketplace for both commercial and military products: the use of "offsets" (Wayne, 2003). Offsets are part of a sales contract in which the buyer agrees to fund an activity that may be directly or indirectly related to the product sold. For example, an offset agreement may contain a provision that the seller invest in the creation of a parts-manufacturing facility in the buyer's country, or provide funding to establish nonmanufacturing infrastructure such as a hospital or telecommunications capability. Today, offsets can have a value ranging from 100% to 300% of the sale price (Anonymous, 2003a). A substantial amount of global sourcing in the aerospace industry is driven by the need to satisfy offset requirements.

Regardless of the drivers for global sourcing, U.S.-based small- and midsize aerospace suppliers face an extremely challenging business environment in which their much larger customers remain strongly focused on unit price—disregarding total costs—and view suppliers as largely interchangeable. That is because buyer–seller relationships in the aerospace industry, like in most other industries (Hays, 2003; Kaufman, 2002; Kobe, 2001; Maremont & Berner, 1999; Nishiguchi, 1994; Stecklow, Raghavan, & Ball, 2003), have long focused on power-based bargaining with regard to purchase prices. As a result, buyers have gained little or no knowledge of suppliers' manufacturing and nonmanufacturing capabilities, inclusive of explicit and

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tacit knowledge, and are thus unable to distinguish when global sourcing is a sensible course of action and when it is not. This sets the stage for reckless pursuit of global sourcing opportunities, many of which can turn out to be expensive mistakes (Emiliani & Stec, 2004).

This paper does not address global sourcing activities that arise as a result of offset agreements. Instead, it examines the use of online reverse auctions as a means for globally sourcing the production of goods and to obtain lower unit prices, two key benefits for buyers cited by the companies that provide online reverse auction services (Emiliani & Stec, 2004). In particular, this paper examines the case of how a long-established aerospace economic cluster located in central Connecticut responded to global sourcing initiatives by large local original equipment manufacturers (OEMs) using online reverse auctions, as well as the outcomes. It also discusses how, at about the same time, the State of Connecticut separately established an industry cluster initiative to help improve the global competitiveness of small- and midsize aerospace component suppliers. In addition, alternatives to power-based bargaining are presented. The findings are generally applicable to other industries, and especially to those that specify engineered components to suppliers that rely on a network of supporting service suppliers to create finished goods.

2. Online reverse auctions

Large aerospace companies began using business-to-business online reverse auctions in earnest starting around 1998. It became a key method for both globally sourcing engineered components not subject to offset agreements and as a tool to bargain with suppliers to reduce the unit price of purchased materials used in the production of durable goods. The principal source of unit price savings is lower labor costs where components are sourced in developing countries, and margin reduction where components are sourced in developed countries. Less frequently, however, cost savings are achieved through fundamental manufacturing process improvement and the elimination of waste (Emiliani & Stec, 2004; Ohno, 1988; Womack & Jones, 1996). Key theoretical foundations supporting the use of online reverse auctions include:

- Lower purchase prices result in reduced costs.
- “Total cost” RFQs represent actual total costs.
- Qualified suppliers are interchangeable.
- Costs are external to the buyer, rather than internally generated (i.e., costs are designed in by buyers).
- Suppliers benefit from participating in online reverse auctions.

This paper examines the veracity of these commonly accepted theoretical underpinnings for the specific case of buyer-designed and specified components.

The companies that provide online reverse auction services are also known as “market makers.” Leading providers of online reverse auction services in the aerospace industry include Ariba, CommerceOne, eBreviate, FreeMarkets, and Orbis Online. Aerospace industry-specific market makers include Cordiem and Exostar. These market makers assist the buyer in creating detailed request for quote (RFQ) packages that categorize parts into logical groupings, by part or process families, to facilitate price estimating and online bidding. Market makers often refer to the RFQs they help create as “total cost” RFQs, thus indicating to both buyers and sellers that the RFQs represent an accurate depiction of all the costs associated with doing business. The process culminates in real-time, dynamic, open bidding conducted over the Internet between tens of suppliers versus the traditional static three-quote closed bidding process. The dynamic bidding process typically results in significantly lower unit prices than the buyer has previously paid, usually between 10% and 30%. Upon conclusion of the online reverse auction, the buyer must implement the results (e.g., switch sources and receive goods) to secure the “gross” savings. Additional details of the online reverse process have been previously described (Emiliani, 2000).

Importantly, the price that buyers pay for the online reverse auction services often includes incentive compensation based on the difference between the current price paid and the maximum theoretically achievable savings identified at the close of bidding, termed the “gross” savings. This motivates market makers to recommend to the buyer that it invite several “qualified” low-cost sources of supply to bid in order to drive down prices. Alternative low-cost sources of supply are usually identified by the market maker, based on the supplier’s self-reported materials and process capabilities and performance in previous online reverse auctions conducted with other customers for similar commodity categories.

Prior work has reported the losses that are incurred in postauction implementation activities to secure the identified savings (Emiliani & Stec, 2002a). The “net” savings is an average of at least 50% less when measured across a broad market basket of product and service commodity categories (Center for Lean Business Management [CLBM], 2003). Thus, the amount of savings that buyers actually achieve is, in most cases, much less than that portrayed by the market makers. In essence, the actual costs are usually higher than that depicted by so-called “total cost” RFQs (Emiliani & Stec, 2004).

Online reverse auctions are widely perceived by incumbent suppliers as a divisive purchasing tool designed principally to drive down unit prices (Emiliani & Stec, 2004; Richards, 2000; Tulder & Mol, 2002) without adequate consideration given to other important measures of performance or production capability (Bartholomew, 2001, 2002; Emiliani & Stec, 2004; Kobe, 2001). Recent studies have concluded that online reverse auctions damage a buyer’s long-term performance by creating distrust among its incumbent suppliers (Emiliani & Stec, 2004; Jap, 2001). One such source of distrust arises when buyers use online reverse auction to test the market with no real intention of switching sources, but instead to drive down the unit prices of incumbent suppliers. Attempts to mitigate distrust between buyers and suppliers has resulted in the creation of a *voluntary* online reverse auction "code of ethics" in the U.S. auto industry (Kisiel, 2002a, 2002b, 2002c; Original Equipment Suppliers Association [OESA], 2002), a "good trading practice" guideline in the European aluminum foil industry (European Aluminum Foil Association [EAFA], 2002), and recommendations on the correct use of online reverse auctions (Beall et al., 2003; Goetting, 2002).

The use of online reverse auctions by major U.S.-based aerospace companies to globally source component part production has declined significantly over the last 2 years due to the following factors (Emiliani & Stec, 2001, 2002a, 2002b, 2004):

- Poor bid lot structure by the buyer or market maker.
- Deficiencies in technical information: for example, missing dimensions on blueprints, incorrect or missing specifications, or specifications subject to misinterpretation.
- Lack of local infrastructure to perform special processes (e.g., electroplating, welding, nondestructive inspection, shot-peening, grinding, etc.), or provide special subcomponents such as bearings.
- Inadequate resources expended by the buyer to qualify new sources of supply and support production.
- New suppliers that win the work were often unable to meet price, quality, delivery, or other requirements.
- Buyer experienced long delays in securing the "net" savings.
- Higher costs associated with dual sourcing (schedule overlap) when switching suppliers.

It is not surprising that some or all of the work returns to the incumbent supplier after 6–18 months (Emiliani & Stec, 2004). The online reverse auction purchasing tool appears to have largely run its course in the aerospace industry for engineered components—at least until market makers or buyers develop effective solutions to these systemic problems.

3. Connecticut aerospace industry cluster

The State of Connecticut formed a public–private sector partnership in 1999 called the "Governor's Council on Economic Competitiveness and Technology" (Porter & Miller, 2003; Waldron, 2002). The council consists of industry leaders, legislators, academics, union representatives, and public sector representatives, and has a mission that includes: "[to] promote innovation, productivity and competitiveness through industry cluster economic development" (Department of Economic and Community Development [DECD], 1999). The industry cluster initiative is intended to improve the competitiveness of businesses in key industries, which will in turn expand the state's economy. The role of the public sector is to "support and facilitate cluster activation" (DECD, 1999). The industry cluster economic development strategy was based on the work of Michael Porter (Porter, 1998; Porter & Miller, 2003).

Clusters are a dense concentration of competing, complementary, and interdependent firms within a general industrial category, such as "aerospace," that make substantial contributions to local economic activity. Clusters result in improved productivity and competitiveness, innovation, and the creation of new businesses and also have numerous intangible benefits including lower transaction costs (Porter, 1998). The much larger OEM aerospace customers, whether located near or far from the cluster, enjoy these benefits and do not bear any costs associated with direct investment. While the benefits are many and varied, clusters that do not enjoy long-term support and development by a large OEM are vulnerable to organizational dynamics that can reduce individual or group competitiveness (Dyer & Nobeoka, 2000; Nishiguchi, 1994; Porter, 1998; Womack, Jones, & Roos, 1990).

In July 1999, the Aerospace Components Manufacturers (ACM) cluster was formally recognized and activated. It began with a core group of about 30 small- to midsize component manufacturers, and managed by a newly formed nonprofit 501C(3) corporation (ACM, 2003) whose board of directors included member company presidents. The ACM created a plan to achieve "worldwide recognition as a premier source for aerospace components." A principal focus of the ACM was the adoption by member companies of Lean production principles and practices to improve competitiveness (DECD, 1999, 2003; Ohno, 1988; Womack & Jones, 1996). Support from the state included funding for "progressive manufacturing practices" (i.e., training in Lean production methods) and "workforce development" designed to expand workers' skills. The State's investment in cluster activation was matched by member company contributions at a ratio of approximately 1:4; thus, member companies provide about 75% of the funding.

The aerospace components manufacturing cluster, inclusive of their subtier suppliers, existed informally—that is to say, not recognized via a state-sponsored cluster initiative—for over eight decades, with roots in metals and metal products manufacturing dating from the late 1700s (Porter & Miller, 2003). The aerospace components cluster served the needs of Connecticut-based OEM customers such as Pratt and Whitney, Hamilton Standard (now called Hamilton Sundstrand), and Sikorsky, all units of United Technologies Corporation, and others.

The suppliers are concentrated principally along a 50-mile stretch of Interstate 91, from Granby to Middletown, known as the Connecticut River Valley region. The informal cluster consisted of hundreds of small- and midsize suppliers, from machining to metal forming to surface finishing to nondestructive testing and related firms, resulting in a dense network of companies with broad capabilities to manufacture a wide variety of aerospace propulsion, airframe, and support system components. Difficult economic conditions at various times over the last 20 years have resulted in numerous business closures, bankruptcies, and some mergers and acquisitions. Despite this, the cluster—recognized both formally (i.e., the ACM) and informally—still possess considerable capabilities, remains a unique asset, and is an important contributor to Connecticut's economy.

The intangible benefits to large OEM customers of the long-standing informal cluster include:

- Short supply lines
- Easy communication
- Knowledge sharing
- Skilled labor pool
- Rapid response to part shortages
- Capacity to satisfy surges in customer demand
- Personal relationship building (ethical context)
- Cooperation among cluster members, when needed
- Well-established infrastructure, both technical and logistic
- Creation of new businesses to satisfy the OEM's needs

It should be noted that the Connecticut aerospace manufacturing cluster developed on its own, without purposeful sponsorship or long-term development by the Connecticut-based OEMs, though they did attempt at various times over the last 20 years to help improve their supplier's performance using various methods. Most of these efforts were largely unsuccessful because they were short-term "program-of-the-month" activities, often rooted in power-based bargaining. Instead, the suppliers that survive today typically made their own advances in production capabilities and productivity driven by competitive forces within the aerospace industry.

The component and subtier suppliers, while cordial and generally trusting of one another, largely acted as independent entities and thus competed against each other in ways that diminished their collective interests. They did not understand themselves as a cluster, and consequently did not realize that there could be substantial benefits associated with much closer collaboration (noncollusive context) and offering OEM customers higher value-added goods and services.

In the early 1990s, the competitive landscape within the aerospace industry began to change dramatically. OEM customers demanded much lower prices, higher quality, and shorter lead times. No longer would large OEMs be run by the best engineers; they were now run by MBAs, with an intense focus on cost reduction, margin expansion, cash flow, and stock price. This came as a shock to most suppliers, and it took years for most of them to completely accept the change. In the late 1990s, it became apparent that something had to be done. The question was, who should develop and improve the capabilities and competitiveness of the cluster: the cluster members, or the OEMs?

In general, the senior managers of large aerospace OEMs operate with the belief that their suppliers are completely responsible for their own fate, rather than valuable resources to support and develop over the long term as is done by some large OEMs in other industries (Bounds, 1996; Bounds, Shaw, & Gillard, 1996; Dyer & Nobeoka, 2000; Nishiguchi, 1994; Sonoda, 2002; Womack et al., 1990). Realizing this, a core group of about six cluster members decided in 1997 that they should take responsibility for improving their own situation and seek modest support from the State of Connecticut. This action would also benefit current customers, as well as new customers that cluster members sought, if they could improve their competitiveness using Lean production principles and practices.

In the 1990s, senior managers at large OEMs typically viewed the local aerospace cluster as deficient, principally with respect to pricing, and otherwise viewing suppliers as essentially interchangeable. This sent a signal, interpreted by both OEM employees and suppliers, that quality and delivery performance were less important. Incumbent cluster suppliers were seen as high unit price sources for recurring production materials, while new global suppliers represented opportunities for obtaining lower unit price, reducing the cost of goods sold, increasing cash flow, and thus raise the stock price. Unfortunately, finance and accounting education, as well as the financial management information systems used by most large corporations support this simplistic view.

In reality, the sourcing choice, absent of offset agreements, is better represented as:

- Local industry cluster → high unit price, lower total cost
- Global supplier → low unit price, higher total cost

If large OEMs were cognizant of total costs, they could more easily and directly satisfy the financial aspects of an offset agreement, without resorting to creative accounting (Anonymous, 2003a), and reduce their financial liabilities on the balance sheet. It might also reduce the total number of offsets. It is surprising that the finance executives of large aerospace OEMs have not rushed to understand total costs. The ACM, therefore, has four key challenges:

1. Teaching their current U.S.-based customers to understand total costs and the benefits of sourcing in industry clusters, features that senior managers at large non-U.S. based aerospace OEMs appear to understand better.
2. Expanding efforts to apply Lean principles and practices to all business processes (Emiliani et al., 2003; Emiliani & Stec, 2004).
3. Generate sales from large non-U.S. aerospace companies—global sourcing in reverse.
4. Continue working together and grow.

While the senior managers of long-time U.S.-based customers typically do not favor their incumbent suppliers at the present time on a unit price basis, new non-U.S. customers are finding U.S.-based cluster companies highly capable and competitive on a total cost basis. In addition, these new customers are using highly disciplined conventional cross-functional strategic sourcing strategies and practices, rather than new technological solutions such as online reverse auctions, to identify, qualify, and develop new sources of supply. The cluster companies thus must confront and manage a difficult paradox in challenging economic times: being viewed by long-time customers as noncompetitive, while at the same time being viewed by new customers as globally competitive—with each customer group possessing data that support their view.

Global sourcing to developing nations can have many positive attributes and may indeed be the correct solution under certain circumstances. However, it can also inadvertently result in the dismantling of all or part of a well established and globally competitive U.S.-based industry cluster, developed and paid for over decades by a panoply of stakeholders, if total costs are not understood (Womack, 2003). This outcome can be directly tied to long-term patterns in buyer–seller relationships that favor power-based bargaining, which in turn provides buyers with little or no knowledge of suppliers' manufacturing and nonmanufacturing capabilities. Online reverse auctions have the capability to deconcentrate a cluster, although this outcome was not achieved in Connecticut's aerospace cluster over the last 5 years. Perhaps it can do so in the future, which would be an unfortunate outcome that senior managers of OEM companies should be more concerned about. Offset agreements, however, are capable of deconcentrating an industry cluster much more rapidly.

4. Collaborative problem solving and knowledge-sharing networks

The online reverse auction purchasing tool is a new technological solution to cost problems. Most senior managers find the potential savings too great to ignore, and eagerly embrace online reverse auction services (Richards, 2000; Smeltzer & Ruzicka, 2000; Tully, 2000). However, the reality is that online reverse auctions have failed to live up to expectations with regard to global sourcing and unit price reduction, let alone total cost reduction, for aerospace components (Emiliani & Stec, 2002a, 2004). For many companies, the "reduce costs at any cost" mantra ends up resulting in embarrassing and expensive mistakes, including sourcing work back to the original supplier. In addition, if the OEMs corporate ethics policy contains specific references to fairness or fair competition, building long-term relationships, trust, respect, or conducting business free of deception or coercion, then using online reverse auctions will likely violate the company's code of ethics (Emiliani & Stec, 2002b).

The market makers claim many benefits for suppliers (Beall et al., 2003; Emiliani & Stec, 2004), but cannot substantiate them save for a few isolated testimonials. Nor do they possess data supporting their claim that reverse auctions improve relationships between buyers and sellers (Emiliani & Stec, 2004). In fact, contract terms and conditions generally drive buyers and sellers apart, as it simply shifts the cost burden from buyer to seller (Emiliani & Stec, 2001). Importantly, suppliers view online reverse auctions as opportunistic behavior by buyers. It is not surprising that this then results in opportunistic behavior among most suppliers, principally retaliatory pricing; that is, charge higher prices when the opportunity to do so arises (Emiliani & Stec, 2004). The overall impact of online reverse auctions is to degrade the competitive capabilities of both buyers and sellers, and does not help engineering, operations, purchasing, marketing, or finance learn how to avoid high costs from the start (Emiliani & Stec, 2002a, 2002b, 2004). In summary, online reverse auctions, rooted in power-based bargaining, offer no real benefits for buyers or sellers.

The use of online reverse auctions by large aerospace OEM clearly indicates that senior managers do not understand the root cause of their cost problems, which typically lies in the design of goods, and historically done in the absence of cross-functional and interorganizational collaboration. So what can they do to better manage costs? First, they are going to have to overcome strongly embedded organizational routines that intentionally or inadvertently marginalize the interests of other key stakeholders.

Global sourcing, just like local sourcing, requires people to work together and solve problems. In short, they have to get along. If power-based bargaining dominates local supplier relationships, then is there any doubt that it will also dominate new global supplier relationships and eventually lead to poor outcomes? Importantly, the aerospace industry treats employees in much the same was as they treat suppliers—as entities to bargain with (Emiliani, 2003). So employees, driven by senior managers to reduce costs, often at all costs, treat suppliers in self-similar ways. Before external relationships can be improved, internal relationships must be improved. Thus, power-based bargaining must be abandoned as a principal tool for governing internal relationships. Only then can external relationships with suppliers be improved. Both employees and suppliers must be viewed as valuable resources to develop and improve, rather than exploit (Dyer & Nobeoka, 2000; Fujimoto, 1999; Nishiguchi, 1994; Toyota, 2001; Womack et al., 1990). While this would be a major paradigm shift within the aerospace industry, the consequences of not making the shift are enormous, as demonstrated by the U.S. auto industry.

The U.S. auto industry has a long, well-documented history of power-based bargaining with its suppliers (Kobe, 2001; Miel, 2003; Nishiguchi, 1994; Womack et al., 1990) and union employees. It is now widely acknowledged that this behavior has become a significant factor in reducing the competitiveness of the U.S. auto industry over the last 20 years (Kosdrosky, 2003; Sherefkin & Wilson, 2003; Treece, 2003). The annual negotiations for price reductions, which largely ignore suppliers' costs, has eroded suppliers' margins and threatened their ability to reinvest or even exist at all (Chappell, 2002a; Wilson, 2003a). As a result, trust between the "Big Three" American automakers and their domestic suppliers has fallen to a 10-year low (Bennett, 2002; Sherefkin & Armstrong, 2003). Many senior managers are aware of the problem, and some have begun to act (Sherefkin, 2002), yet there is no evidence that the common metric used by purchasing organizations—purchase price variance—has been eliminated to help create new behaviors (Butters, 2002).

In contrast, automobile OEMs that practice collaborative problem solving and help build the capabilities of their suppliers achieve superior competitiveness and stronger financial performance (Bounds, 1996; Chappell, 2002b; Dyer & Nobeoka, 2000; Nishiguchi, 1994; Wilson, 2003b; Womack et al., 1990). It is not surprising that domestic suppliers strongly prefer to work for the transplant automakers, particularly Toyota and Honda (Bennett, 2002; Sherefkin & Armstrong, 2003).

The long-embedded practice of power-based bargaining, recently expanded through the use of online reverse auctions, threatens the competitiveness and financial performance of the aerospace industry. Its fate will follow a path similar to the "Big Three" U.S. automakers, but with an important difference. There is no large aerospace OEM or large tier one supplier in the United States that sponsors collaborative cost reduction and the creation of knowledge-sharing supplier networks as part of their long-term sourcing strategy. In other words, the systematic approach to supplier development as pioneered by Toyota and Honda has been ignored or at least inconsistently applied.

The result of decades of zero-sum negotiations will likely be continued, resulting in slow, broad-based, industry decline, while working within the aerospace industry as an employee (Anonymous, 2003b), or supplier becomes increasingly less desirable. However, it may not be too late to reverse the trend. The senior management team of one or two large U.S. or non-U.S.-based aerospace OEMs could recognize the opportunity that stands before them. They can kick the power-based bargaining habit and begin to make the necessary changes in internal (Emiliani et al., 2003) and external relationships (Dyer & Nobeoka, 2000), business processes, tools, and metrics. Buyers and sellers will next have to learn the disciplined use of collaborative problem-solving routines and cost management processes such as target costing, value engineering, value analysis, and kaizen (Cooper & Slagmulder, 1999; Fujimoto, 1999; Monden, 1995; Nishiguchi, 1994), and improve these processes over time and over generations of managers. The benefits include higher profits and long-term competitive advantage, whether sourcing is local or global, as demonstrated in the auto industry (Bennett, 2002; Bounds, 1996; Bounds et al., 1996; Chappell, 2002b; Dyer & Nobeoka, 2000; Nishiguchi, 1994; Wilson, 2003b; Womack et al., 1990).

5. Summary

This paper examined the use of online reverse auctions to source engineered aerospace components in the global aerospace supply chain. The driving source for global sourcing is the buyer's strong interest in quickly obtaining lower unit prices due to lower labor costs in developing countries, and margin reduction where components are sourced in developed countries. Online reverse auctions are shown to be a technology-assisted form of power-based bargaining that was initially unsuccessful as a global sourcing solution. This is principally due to the lack of infrastructure in developing countries to support the production of goods made to company-specific specifications and local capability for performing important secondary special processes. These barriers will likely be removed in coming years as large aerospace OEMs work to establish the necessary infrastructure, likely facilitated by offset agreements.

Global sourcing may indeed be an appropriate solution for reducing the price of purchased production materials if the true nature of the cost problem is understood. In general, however, senior managers of large OEM aerospace companies tend to pursue low cost at any cost, setting the stage for unanticipated cost, quality, and delivery problems. In most cases, high labor costs are not the root cause of the price problem. Instead, there are massive amounts of waste in production (Womack, 2003; Womack & Jones, 1996) and nonproduction (Emiliani et al., 2003) processes. Global sourcing is typically promulgated by financial education and information systems that focus exclusively on unit price and do not take into account the total cost of procurement, including the costs associated with establishing new sources of supply. If these costs were taken into account, then long-established domestic sources of supply might indeed be globally competitive.

Collaborative cost reduction and the creation of knowledge-sharing networks are ultimately more efficient solutions, both socially and economically, to competitive pressures that drive the need for ongoing improvements in cost, delivery, and quality performance. However, this requires the abandonment of short-term, power-based bargaining routines and associated metrics, and the common view that suppliers are readily interchangeable. Large OEMs can instead establish long-term sourcing strategies that include disciplined interorganizational cost management and capability building. Genuine bilateral continuous improvement has much greater value because it leads to lower costs, higher quality, enables faster response to changing market conditions, and thus delivers greater end-use customer satisfaction.

Key theoretical foundations supporting the use of online reverse auctions were shown to be wholly or partially flawed. Ultimately, online reverse auctions do not help the buyer or seller understand the root cause of cost problems. This indicates the need for additional research to improve practitioner and academic knowledge of the domain of successful application for online reverse auctions. Currently, the most important areas of study with respect to buyer-designed and specified components are (1) determine the "net" savings that buyers have actually achieved (CLBM, 2003; Emiliani & Stec, 2002a) and (2) quantify each of the purported benefits for sellers (Emiliani & Stec, 2004).

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