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## Online Reverse Auctions: An Overview

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### ABSTRACT

*Electronic commerce (e-commerce) is the fastest growing area in the U.S. economy with electronic procurement (e-procurement) being a major component, and online reverse auctions (ORAs) have emerged as a key e-procurement tool. Since the mid-1990s, ORAs have been gaining in popularity because of their potentially significant positive impact on the profitability of both the buyers and the sellers. Much has been written about the new purchasing paradigm and numerous stories have been reported recently. This paper is aimed at providing a critical review of ORAs by examining their historical developments, different forms, advantages, and disadvantages. In addition, 10 important factors to consider for successful implementation of ORAs are identified and discussed.*

### INTRODUCTION

In the early 1980s, the traditionally-held view of using multiple vendors to reduce supply risk was replaced with a trend toward single sourcing with one or more qualified backups; much emphasis was placed on developing long-term, close buyer-seller relationships (Leenders, Fearon, Flynn, & Johnson, 2002). With the emergence of e-commerce in the 1990s, however, the paradigm of consolidating the supplier base has been challenged with the prospect of exploiting Internet technology to reach many sources of goods and services for the lowest possible cost.

Electronic commerce (e-commerce) involves buying and selling between organizations and/or individuals on the Internet. Today, e-commerce is the fastest growing area in the economy with electronic procurement (e-procurement) being a major component. E-procurement provides a non-traditional approach to reducing the expenditures associated with supply management for both manufacturing and non-manufacturing firms. Its application promises to lower prices of products and provide for higher operational efficiency by automating the conventional labor-intensive approach to supply management. The dollar volume of materials purchased online was \$75 billion in 2000 (Verespej, 2002). According to the latest ISM/Forrester report on technology in supply management, there has been a steady rise in the use of e-procurement since 2001. In particular, 85% of the 600 companies surveyed were making progress toward adopting the new tool (Bartels, Hudson, & Pohlmann, 2003). Table 1 presents some examples of cost savings achieved with e-procurement as reported by Verespej (2002). Additional success stories can be found in Anonymous (2002c), Beall et al. (2003), Kruger (2002), Lydiard-Wilson (2002), Rosen (2000), and Sanders (2003).

**Table 1: Cost savings/reductions from e-procurement.**

Scope		Cost savings/reductions
Industry	Chemicals & adhesives	15% to 20%
	Corrugated paperboard	Up to 32%
	Energy	5%
	Metals & machinery components	19%
	MRO items	40%
	Temporary labor	36%
Company	John Deere	\$75 in administering a purchase order
	Lucent Technologies	60% - 70% in transaction processing time
	Owens Corning	10% on annual corporate purchases
	Texas Instrument	\$55 in processing a purchase order
	3M	\$80 in invoice processing and 30% in error rate

E-procurement is an umbrella term that encompasses a number of tools with electronic capabilities used to replace the conventional purchasing process. These typically include enterprise resource planning systems (ERP), electronic catalogs, electronic requests for quotes (RFQs), online reverse auctions (ORAs), and public as well as private electronic marketplaces or exchanges (Roberts, 2001). Online reverse auctions, the Internet-based versions of reverse auctions, are among the most common practices employed with e-procurement and they have been in the corporate limelight particularly during the last few years. According to a Benchmark E-procurement Survey conducted by *Purchasing Magazine* in early 2002, buyers are expressing growing interest in ORAs, online design/collaboration systems, and electronic data exchange (Anonymous, 2002a). Large organizations such as Dell, Hewlett Packard, Palm, GlaxoSmithKline, Bechtel, Volkswagen, and Metro Group have increased the use of ORAs to improve their acquisition process and lower component costs (Beall et al., 2003; Chin, 2003). In 2001, Sun Microsystems spent \$9 billion on direct and indirect materials with about \$1 billion bought via ORAs (Shah, 2002).

ORAs, which are also referred to as upside down auctions, backward auctions (Taylor, 1998), online bidding, dynamic pricing (Kannan & Kopalle, 2001), competitive bidding event (Rangan, 1998), and electronically assisted negotiation (Harris, 2001), offer ample opportunities for savings in the material acquisition process. Beall et al. (2003) estimate that 10 to 15% of the total purchases for all American businesses, which amounted to \$4.1 trillion in 1999 (Davies, 2002), could be sourced through ORAs. If the annual procurement expenses were reduced by 10 to 20%, then approximately \$41 to \$123 billion could be saved by using ORAs.

This research project is motivated by our belief that ORAs are the value proposition for e-procurement in the 21<sup>st</sup> century. Much has been written about them in the last few years (Merson, 2000; Emiliani & Stec, 2001a; Neumann, 2001; Rothkopf, 2001; Moser, 2002a, 2002b; Stein & Hawking, 2002; Schoenherr, 2004); however, treatment of ORAs has been incomplete for the most part. The current body of literature in this area is in need of more comprehensive studies on this purchasing tool of increasing importance.

The purpose of this paper is to bridge the gap by offering an integrated perspective of the history, taxonomy, advantages, and disadvantages of ORAs. Existing works are carefully reviewed and relevant information is synthesized to gain insights into the new approach to buying goods and services. With the input from three experienced purchasing professionals in different industries, we identify 10 key factors that should be considered to ensure successful ORA implementations. Each factor is then analyzed in detail and appropriate guidelines are provided to aid supply managers in making sound business decisions.

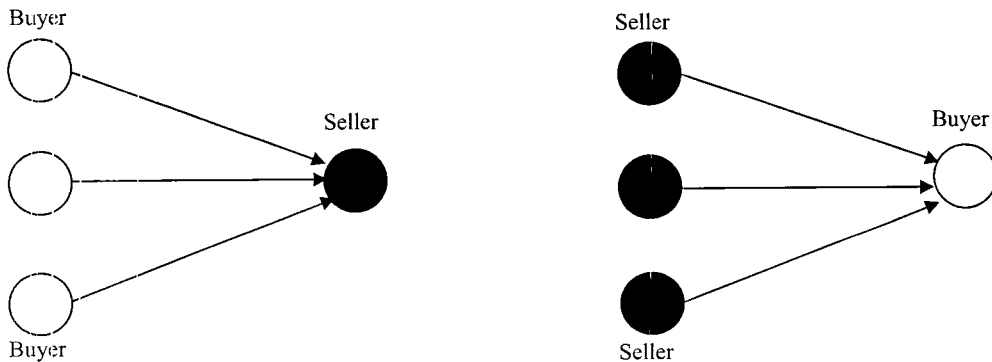
## ONLINE REVERSE AUCTIONS

### History of Auctions

Auctions originated as early as 500 B.C., when Babylonian communities held annual events to distribute women eligible for marriage to the highest bidder (Cassady, 1967). In the Roman Empire, soldiers often claimed the sites they conquered in military victories and sold them at public auctions. In the early 17<sup>th</sup> century, auctions were held in ancient Buddhist temples to raise funds to operate the facilities (Prince, 1999).

Great Britain was the first country to popularize auctions for commercial exchange of materials about 400 years ago. At that time, auctions regularly occurred in taverns and coffeehouses to sell artwork, furniture, and other commodity items (Cassady, 1967). In the mid 18<sup>th</sup> century, two prestigious auction houses were established in London: Sotheby's in 1744 and Christie's in 1766; they are still in operation today. During the colonial period, immigrants to the United States used auctions to sell animals, agricultural products, farm equipment, and, unsurprisingly, slaves (Reynolds, 1996). Today, auctions are prevailing in the U.S. corporate world for the liquidation of goods or for the sale of items otherwise unmarketable through conventional channels.

Reverse auctions (RAs) are the opposite of traditional auctions. In a traditional or forward auction, interested buyers bid against each other to purchase an item until the one willing to pay the highest price remains. In a reverse or backward auction, however, a buyer solicits quotes for a product from multiple sellers, who bid against each other to get the business until the one willing to sell at the lowest price remains. Graphical illustrations of the two types of auctions are shown in Figure 1.

**Figure 1: Two Types of Auctions**

The first RA of British government debt was conducted by the Bank of England in January 1989 for £500 million nominal of stock (United Kingdom Parliament, 1989). In the U.S., the earliest RA program appeared to be established at General Motors in the early 1990s (Vasilash, 1993). In his seminal article on reverse auctioning, Karras (1995) explained why the new purchasing practice would work and what potential dangers might accompany it. The discussion generated much enthusiasm for RAs in the business community, which eventually facilitated the migration of reverse auctions to the Internet and gave rise to such auction houses as FreeMarkets and Priceline.com.

In 1994, Glen Meakem of General Electric (GE) recommended the use of ORAs but was told by the company's management that they did not represent the best strategy to pursue at that time. Subsequently, he left GE to found FreeMarkets, Inc., which is now one of the major players in the electronic auction arena (Hannon, 2001b). Priceline.com, the first company to apply ORAs in the open market, allows prospective passengers to post requests for airplane tickets on its website with airlines vying for the business by lowering fares. In 1998, Priceline.com earned a patent covering the so-called "bilateral buyer-driven commerce," which protects its Internet-based reverse auctioning format (Anonymous, 1998).

Presently, a large number of businesses compete for a share of the market where ORAs exploit the strength of the Internet to deliver a revolutionary, customer-focused shopping environment. Numerous private organizations and government agencies have also entered the ORA arena and are conducting reverse auctions on the Web.

## Two Generations of ORAs

The process of adopting ORAs over the past half decade may be divided into two distinct stages (Davies, 2002). During the first two to three years of its existence, not much was known about the ORA and interested companies normally contracted to third-party application service providers (ASPs), which are commercial service firms that deliver, manage, and remotely host software applications through centrally located servers in a rental or lease arrangement (Norris, 2000). While effective, this first-generation model of hiring ASPs to host ORAs proved to be expensive due to the service fees charged as well as the costs of the follow-on business. In addition, it took the purchasing tool out of the buyer's hands.

As ORAs have become much better defined and many of the uncertainties and risks associated with this new electronic tool have been considerably reduced, more and more organizations are building self-service systems in-house to carry out electronic procurement activities (Davies, 2002). Negotiating software licensing agreements and developing necessary internal capabilities makes it possible to run an ORA from a personal computer. This second-generation model not only enables the buying company to achieve the same results for significantly less time and money, but also puts the purchasing tool back in the buyer's hands.

## **Taxonomy of Online Reverse Auctions**

ORAs differ and may be characterized by three key attributes: transparency of information (i.e., availability of bidding information to the bidders during the course of auction), termination criterion (i.e., when the auction is considered to be closed), and decision criterion (i.e., to whom the contract should be awarded at the end of the process). Consequently, there are several different ways of classifying ORAs depending on the characteristic or combination of characteristics that is considered.

Transparency of information. On the basis of information transparency, an ORA will fall into one of two categories: open bid and sealed bid. With an open bid, information on all of the bids, or the lowest bid, or the bidder's own ranking is revealed in real time, but the identity of bidders is not disclosed throughout the auction process. This type of ORA generally stirs up more competition since the participating sellers can continue to offer the buyer more for the same money or quote a lower price. With a sealed bid, all bids submitted are secured and no information about any bid or any bidder's identity is available. For example, Burlington Northern Santa Fe (BNSF) Railway frequently conducts sealed-bid ORAs with no public knowledge of bidding prices. This results in less push-back from the sellers (Ytuarte, 2002).

Termination and decision criteria. Based on termination criterion and decision criterion combined, there are four types of ORAs: reverse English, reverse Vickrey, reverse Dutch, and reverse Yankee. Reverse English (or standard) is probably the most common form of ORA, where each seller offers the price at which it is willing to sell an item to the buyer. At the end of the auction, the item is purchased from the lowest bidder at its bid price. This kind of ORA can involve a single product or multiple products and the buyer may be allowed to specify a "reserve price," which is the highest price the buyer is willing to pay for the requested product.

Reverse Vickrey (or second price) is similar to reverse English except that the lowest bidder sells the product at the price offered by the second lowest bidder. Sellers taking part in this type of event have the incentive to bid what they think the item is worth without worrying about what other participants will bid. Vickrey (1961) has shown that the buyer will ultimately save more money if the lowest bidder is paid the second lowest price instead of the lowest one.

Reverse Dutch is designed for the situation where a number of identical items are wanted. The buyer typically specifies the start bid as well as the exact number of items that it wishes to acquire at that maximum price. The sellers then bid at or below that level for the number of items that they are interested in selling. In the end, the lowest bidders earn the right to sell those items at the lowest successful bid price.

Finally, reverse Yankee is a variation of reverse Dutch. In this case, successful bidders sell what they bid as opposed to selling at the price determined by the lowest bidder.

## **ADVANTAGES AND DISADVANTAGES OF ORAS**

### **Advantages to Buyers**

ORAs provide an opportunity to obtain better prices. Goods can be purchased at lower costs partly because the nature of online purchasing quickly drives prices downward, and partly because the certainty of immediate sale and contract acceptance means that the normal mark-up included in the selling prices for covering risks can be eliminated (Neef, 2001). The savings on an average purchase range from 10% to 20% (Beall et al., 2003). Moreover, bids received reflect the going market rate and thus generate valuable pricing data for planning future buys. They also serve as a benchmark against which a purchasing agent's performance may be compared.

The supply base can be expanded with ORAs. Electronic posting of procurement requests can reach a wider audience and help explore potential new suppliers. ORAs offer databases of evaluative information about various companies for similar purchases in the future and can provide quick identification of alternative and backup sources of supply (Sanborn, 2001). For example, Jaguar has achieved considerable success in using ORAs as a means for identifying new suppliers (Schlack, 2001).

With ORAs, the need for phone calls, faxes, and face-to-face meetings is minimized or eliminated and the purchasing cycle is shortened between 40% (Beall et al., 2003) to 50% or more (Moser, 2002b). The smaller time requirement to reach suppliers contributes to not only faster reaction to changing market conditions but accelerated product development. As a consequence, customer satisfaction is increased and a stronger buyer-seller tie is forged. Furthermore, real-time spot-buying via ORAs provides increased flexibility in acquiring goods, which leads to better management of fluctuations in supply and helps to reduce the risk of a stock-out (John, 2001).

Procurement costs can be cut considerably in an ORA environment. Savings in expenses are realized due to less travel, lower resource requirement, smaller staff, and a more streamlined process for collecting bids. The administrative efforts in dealing with many sellers at once is also reduced due to a decreased need to re-enter data, easier interaction with sellers, and a more centralized single-system repository for data. One notable example is Whetbread's 15% savings in process improvements and product costs as a result of using ORAs (Adshad, 2002).

The ORA also permits purchasing professionals to become more efficient as it provides them with automated transaction tracking as well as storage and exchange of standardized electronic documents critical to procurement. Due to the anonymity associated with ORAs, the buying company's exposure to unwanted sales pitches or cold calls is minimized (Mollman, 2000). Thus, buyers are freed up to focus on value-added core activities such as post-bid analysis, price negotiation, review of supplier performance, and so on.

### **Advantages to Sellers**

The seller involved in an ORA can benefit from the online acquisition process as well. First and foremost, the playing field is leveled and every participant is given an equal opportunity to get its foot into the door (Atkinson, 2000d). In particular, through ORAs, small and medium-sized organizations can boost their public exposure as well as compete with larger firms. Because of the expanded marketing channels, it is possible for enterprises of all sizes to identify new buyers and increase sales (Bettley, 2001) with real-time visibility in the markets.

In an ORA the seller is allowed to adjust the bid over and over again or even bow out of the process at any time, which is not possible in a traditional paper-based environment. In an open-bid auction, a selling company is provided with information about the competitors' pricing so that it can modify its bid to maximize the likelihood of winning the contract. A seller can also become more competitive since it can benchmark its own cost structure against those of others in the marketplace. Eventually, the use of ORAs should lead to greater efficiency in the supply base because suppliers will be more willing to make necessary investments in training, procedures, equipment, and capacity tailored to the buyer's specific needs (Jap, 2000; 2003).

ORAs are a relatively inexpensive approach to identifying new customers and expanding business since the seller does not need its own website to take part in the event. The only requirements are an e-mail address and access to the Internet. Another advantage of the online purchasing tool is that while pricing information might be shared in a number of different forms, individual seller's identities are always protected.

### **Disadvantages to Buyers**

In spite of the growing interest in ORAs, a number of disadvantages to the buying company have been identified (Atkinson, 2000a; Chin, 2002; Kwak, 2002; Warner, 2002). One of the drawbacks pertains to the cost of conducting an ORA. Registration with a reverse auction house requires subscription fees in addition to a charge based on a certain percentage of the total purchases. In the case of developing in-house solutions, building and administering a firm's own ORA program entails substantial expenses too. Typically, a large corporation could spend upwards of \$40 million to establish a private trading house (Moser, 2002b).

Although the ORA takes only a small amount of time to run, much planning, preparation, and training is required for the system to be successful (Michels, 2001). Moreover, it can be challenging to get purchasing professionals in the buying company to overcome their allegiance to the traditional bidding approach. While ORAs can save money on purchases of indirect materials and MRO items, John (2001) maintains that using them to "spot buy" direct materials usually costs more than long-term, structured contracts.

Another shortcoming of ORAs is that they may hamper the supplier relationship by stripping the buyer of many value-added benefits available through direct negotiations, such as price discounts for multiple contracts and referrals. Harris (2001) reports that more experienced buyers at GE view the new purchasing model as a threat to the long-established rapport with their vendors. Clearly, there is some risk in replacing a trusted supplier with a potentially unreliable new source selected through an ORA (Ytuarte, 2002), since the latter may not share the same business values, quality expectations, or customer service standards. Eventually, the total cost can rise if the seller chosen fails to ship the product as promised and the buyer has to return to the former supplier.

### **Disadvantages to Sellers**

Many suppliers have been less than enthusiastic about ORAs for several reasons. One of the main concerns is that ORAs present a threat to their bottom line and survival. This is because profit margins are normally squeezed and corporate viability may be jeopardized in this type of cutthroat competition for low prices. In the eyes of many sellers, the new procurement method represents little more than a ploy on the part of the buyer to slash costs to the bone and improve its own profitability. Product quality is often ignored with ORAs and suppliers are forced to either bid below their actual cost to get the business or lose it to the rivals.

Harris (2001) suggests that some vendors have no intention of actually winning the business in an ORA. Instead, they take part in it merely to drive down the price, attempting to bid their competitors to death by forcing them into money-losing contracts with the buyer. Other sellers, because of their knowledge about the competitors' bids in an open-bid ORA, may be influenced to offer unrealistic prices to receive the contract, and subsequently try to release itself of the commitment (Smeltzer & Carr, 2002). As a consequence, some companies have policies against getting involved in ORAs. Such a lack of interest in participation often makes the market less competitive than it could be and, therefore, defeats the purpose of obtaining goods at the lowest possible prices.

ORAs may also negatively affect the sellers' partnership with the buyer because they place undue pressure on the industry's supply base. Suppliers are watchful since the Internet-based supply management tool goes against years of well-forged relationships and there is no guarantee for future business. Improper use of the ORA may discourage sellers from making necessary investments for improving their operational efficiency or providing intangibles that are traditionally deemed important, such as favorable payment terms and post-sale services.

Since the identity of the supplier is hidden throughout the auction, the effect of brand image is eliminated. Consequently, many sellers opt to stay away from anonymous ORAs where their product becomes a mere commodity and their brand is reduced to its lowest common product denominator, price (Chevron, 2000).

## **IMPORTANT CONSIDERATIONS FOR SUCCESSFUL ORA IMPLEMENTATION**

Although there is a general consensus that ORAs provide an exciting forum for the buyers and the sellers to do business, the outcomes from using the Internet-based procurement tool vary greatly from organization to organization as well as from industry to industry. To account for the mixed results, we set out to critically review the existing literature and a number of practices common to successful ORA programs are uncovered. The findings are subsequently shared with a group of three senior purchasing managers from different industries for comments and suggestions. Ultimately, we develop a set of 10 key factors that should be seriously considered to ensure success in implementing ORAs. These are: (1) market conditions, (2) nature of goods, (3) selection of ORA model, (4) preparation of RFQ, (5) development of auction rules, (6) pre-qualification and invitation, (7) education, communication, and training, (8) running the ORA, (9) follow-up activities, and (10) maintaining buyer-supplier relationships.

### **Market Conditions**

ORAs are more likely to succeed when supply exceeds demand, industry capacity is underutilized, and many suppliers are openly competing. They are more appropriate in a fragmented industry, since the buyer will be in a better negotiating position if none of the sellers is dominant and they are all vying for business (Michels, 2001). Experience has shown that ORAs will work better when there are five or more qualified suppliers with similar

supply capabilities (Moser, 2002b). For instance, Procter & Gamble often purchases commodities through ORAs when a number of equally capable vendors are available and their products are roughly interchangeable (Atkinson, 2000b). According to Davies (2002), it is vital to have at least three qualified sources for the planned buy when more sophisticated goods are involved.

### **Nature of Goods**

Choosing products for ORAs is the most challenging part of the preparatory work, but it is no different from the sourcing of materials in a conventional acquisition process. Both the volume and the type of goods must be considered in arriving at a sound decision. In general, ORAs are most suitable for use with high-volume bulk items where small differences in price lead to savings that add up quickly due to the large quantities. As a rule of thumb, service companies operating Internet-based auction sites normally set a procurement threshold of \$50,000 or more for ORAs (Olsen, 2001). Davies (2002) suggests that the first event should be run at a minimum of \$100,000. The real key is the return on investment.

Although it has been argued that ORAs are applicable to all kinds of purchases (Guillemaud, Farris, & Hooper, 2002), they offer little advantage in situations where product differentiation or quality varies. Consequently, ORAs may prove ineffective when purchasing make-to-order or custom assemblies, strategic components where close buyer-supplier relationships are needed, parts requiring special tooling or setups, and materials where the specifications are incomplete or will change (Kenczyk, 2001; McGinnis & Johnson, 2001; Anonymous 2002c; Beall et al., 2003). Generic, catalog, non-critical, non-strategic, and commodity-type items requiring short lead times and minimal support or follow-on services lend themselves to ORAs, so are fungible items since they are almost identical and price is the most important consideration. As an example, Jaguar conducts spot buying for non-production goods through ORAs (Schlack, 2001), as does GM in purchasing its MRO supplies (Brack, 1998).

While most of the above discussion has focused on the applicability of the ORA to tangible commodities, it is worth noting that the Internet-based procurement tool is also used with intangible professional services where many jobs are open-ended or poorly defined and quoting a net price is difficult if not impossible (Kuo, White, & Rogers, 2003). These include such industries as health care (Arnold, 2000), hotel (Feiertag, 2000), and labor (Atkinson, 2000c), among others.

### **Selection of ORA Model**

Since many organizations could face a significant learning curve in their first ORA, they may wish to adopt the first-generation model by hiring an ASP. Under such circumstances, choosing the right auction house is of paramount significance. Presented below are a few useful selection guidelines.

There are two basic types of ASPs (Davies, 2002). Those that conduct ORAs as an add-on to their other offerings should be considered only if the buying company has a strong corporate and financial commitment to use them. In selecting a firm of the second type, where ORA service is a core business, however, the buyer should carefully evaluate alternative sources based on its needs and organizational objectives before arriving at the final decision. It is generally best to work with an experienced ASP for advice on structuring the new purchasing program to avoid "rookie mistakes." Therefore, it is essential to hire a well-established ASP that can serve as a quality training ground for the beginning user, has a proven record of accomplishments in the business, operates stably, and supports the buyer's existing processes (Davies, 2002).

Besides providing the auction software, an ASP typically helps the buying firm write the specifications for the product to be acquired, invites qualified bidders to participate, and establishes the parameters of the auction like the date, the duration, and the fixed price decrement. In addition, many ASPs work closely with the buying firm in performing pre-auction investigation as well as scoping out the market conditions for the product wanted. The service costs vary widely; however, most ASPs assess a straightforward fee based upon either the transaction or a percentage of the dollar value of the buy (Neef, 2001).

In the event that the buyer opts to adopt the second-generation ORA model by purchasing software systems to manage auctions in-house, a wide variety of choices exist from companies such as Oracle and PeopleSoft. Berger



(2002) suggests that special attention be paid to the following four areas when contemplating new e-procurement tools: (1) identification of the benefits and justification of the expenditures, (2) involvement in the process of creating specifications, (3) understanding end-user, functional, and technological requirements, and (4) general considerations such as training, support, ability to modify, and so forth. Additionally, Umble, Haft, and Umble (2003) propose the following 13-step procedure for selecting technical enterprise software: (1) define corporate vision, (2) identify required functions and features, (3) prepare a list of potential vendors, (4) create a short list of four to six candidates, (5) develop the request for proposal, (6) review proposal submissions, (7) choose two to three finalists, (8) participate in system demonstrations, (9) select the winner, (10) justify the investment, (11) negotiate the contract, (12) run a pre-implementation pilot, and (13) validate the investment justification. Both Berger (2002) and Umble et al. (2003) stress the criticality of support from senior management throughout the evaluation, selection, and implementation process of computer software programs including ORAs.

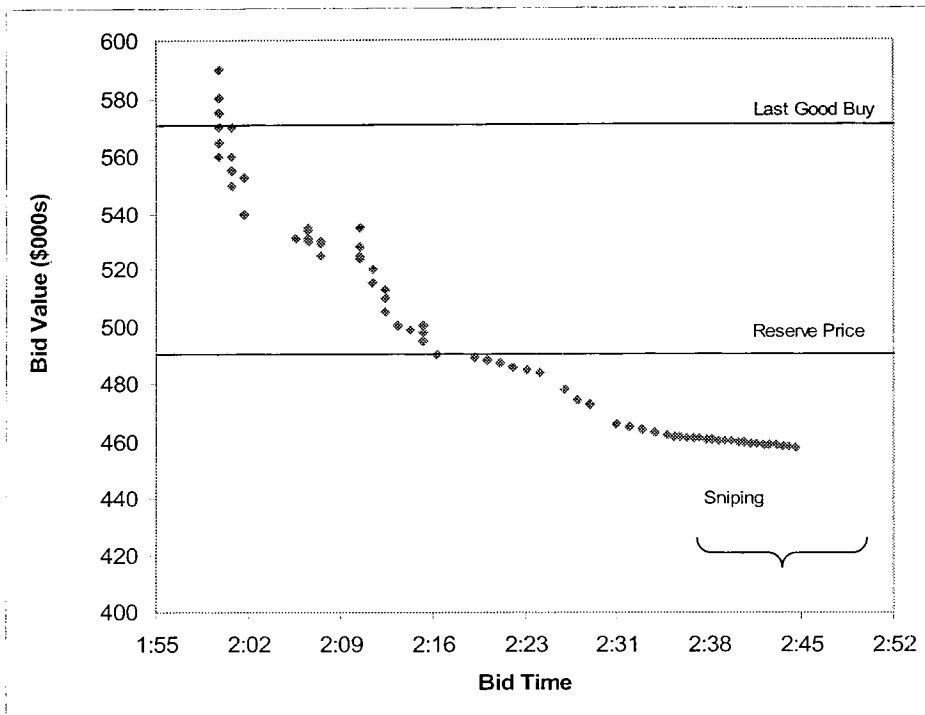
### **Preparation of RFQ**

Anything that can be described can be reverse-auctioned. The key is that the item must have measurable features so that a solid, precise description is possible to make the requirements clear to the sellers. Similar to the traditional process of preparing an RFQ, the buyer must define everything upfront, including design specifications, quantity, quality standards, delivery schedule, payment terms, location of use, lot size, and so forth. In case the requested product is complex or involves a new manufacturing process, other information relevant to the purchase should also be detailed to assist the potential suppliers.

### **Development of Auction Rules**

A reasonable initial price must be specified in an ORA to serve as the starting point of the competitive bidding process. The general rule is to set it at the same level as the price of the buying firm's "last good buy" or the standard industry price (Neumann, 2001). Also to be established is a proper reserve price, which is the price at which the buyer will consider switching sources (Emiliani & Stec, 2002); namely, it is the highest price the buyer is willing to pay for the requested product. If the reserve price is set too low, the buying firm may receive no bidder responses (Beall et al., 2003). In addition, a fixed bidding price decrement needs to be determined so that one seller will not outbid the others by a ridiculous margin of, say, \$0.01 at the very end of the auction. Since ORAs are usually initiated with an advance notice of specific starting and closing times, an appropriate duration for the auction has to be established beforehand depending on the nature of goods to purchase and the level of competition expected. In most cases, the event is completed within an hour. But sometimes the buyer may have to extend the ORA several times.

Typically, the behavior of the bidding process changes as the auction progresses. Early on, the bids submitted by the participating sellers tend to move towards a natural floor-level price, which is normally below the reserve price. However, a flurry of bids with successive minimum decrements often occurs just before the auction ends. This phenomenon of last-minute bidding is described as "sniping" (Daripa & Kapur, 2001) and it is illustrated in Figure 2. The problem with late or sluggish bidding is that it not only deprives other bidders of the opportunity to react but also facilitates collusions or independent pricing well above that predicted by auction theory (Parente, Venkataraman, Fazel, & Millet, 2001). An overtime period is invoked whenever any bid is received in the designated final phase of the ORA (e.g., in the last two minutes) and it may iterate if late bidding continues in the previous overtime period. The additional amount of time allows bidders to react to the snipers and minimizes the potential for pricing rings. As pointed out by Parente et al. (2001), one drawback with this arrangement is that it obligates serious bidders to return to the ORA at the end of the process and remain there through the subsequent extension periods.

**Figure 2: Process behavior of bids in an ORA.**

Restructuring of information contents is also helpful in coping with sniping. This is because knowledge about the bids facilitates the creation of cooperative pricing, and limiting its availability can weaken the foundation of such cooperation. For instance, the ORA may be designed to show only the lowest bid but not the seller's own ranking throughout the auction.

It is also important to develop clear supplier evaluation criteria in an ORA. In principle, a contract can be awarded solely on the basis of price provided that the participating vendors are screened carefully. Buyers, however, realize that additional factors should also be taken into account to find the best overall seller. These may include quality, delivery, reliability, past performance, technical strength, financial stability, cost reduction capability, information technology sophistication, as well as familiarity and comfort with Internet-based transactions.

Today, many online auction houses have built product intangibles into the ORA software and offer contract awarding criteria more complex than mere price comparisons, thus enabling the buyer to more accurately gauge a bid's true value by weighing a broad range of considerations before choosing a supplier (Borck, 2002). As a consequence, the lowest bidder is not always the guaranteed winner. Notable business practices echoing this industry trend of multiple-attribute decision-making process in ORAs include those at Dell (Chin, 2002), Jaguar (Schlack, 2001), BNSF (Ytuarte, 2002), GE (Hannon, 2001b), and the U.S. Navy (Hannon, 2001a).

### Pre-qualification and Invitation

Only sources determined to be in the competitive range should participate in the ORA. Thus, the buyer will be interested in just sellers that are familiar or meet the prescribed requirements (Atkinson, 2000b). For example, the majority of the vendors taking part in Procter & Gamble's ORAs are those that the company has dealt with, is doing business with, or knows about through its own research.

The potential suppliers should be pre-qualified. Only selected qualified sellers are allowed to bid in an ORA (Bhutta, 2003), and the number of vendors to invite and who they are must be determined. Although the buyer will be in a better position when more suppliers are involved, the total number of participants in the ORA should be kept to a manageable level. A maximum of six to 12 sellers is a good standard to follow, and the essence is not the quantity but the quality of the bidders (Davies, 2002).

### **Education, Communication, and Training**

In order to run the ORA smoothly, several conditions must be satisfied. Internally, purchasing professionals and others affected within the buying organization need to be educated so that there is employee buy-in to the new way of doing business. Externally, the sellers have to completely understand what the online procurement tool is and, if used appropriately, it could save them money too.

All invited bidders should be furnished with exactly the same information about the technology to be used, the RFQ, and the auction rules. Questions asked should be clearly and promptly answered. Candid discussions are called for when some level of nervousness about the ORA is encountered especially by incumbent suppliers. It is also crucial to assure all participants that there is no predetermined agenda, the online event is not just an information gathering session, and the business being bid will be awarded.

Another important task at this stage of the ORA planning process is to properly train both the internal purchasing agents and the external pre-qualified sellers. It should be beneficial to schedule a practice session prior to the actual event to ensure that the system works and every participant is comfortable with the bidding templates on the computer.

### **Running the ORA**

Proper actions need to be taken right before and during the electronic bidding process to make the ORA a success. Prior to the start of the auction, all participating sellers should be asked to log on to verify that they are connected. Any problems should be addressed immediately.

If a bidder loses its connection during the ORA and cannot reestablish it immediately, a surrogate mechanism should be in place to remedy the situation. A handy example is the use of a third party to place the bids via a telephone line. Other fail-safe alternatives like a back-up Internet service or a cell phone may also be made available to guarantee ease and continuity of the ORA (Atkinson, 2000c). A seller should be contacted if it takes no action for an extended period of time or if something does not look right (e.g., an unusually low bid). The buyer has the responsibility to stop the auction if any evidence of irregularity is suspected or witnessed, such as collusion, shill bidding, or an auction ring (Prince, 1999).

The buying company must assure the participating suppliers that the integrity of the system will be maintained. The identities of the bidders in an ORA must be protected at all costs. Both the auction duration and the overtime period(s) should be well managed according to the prescribed rules. Additionally, like in a traditional bidding process, all bidders should be treated equally.

### **Follow-up Activities**

Once the ORA ends, the buyer needs to do a few things to bring the process to a satisfactory conclusion. First of all, the bidding interface on the website must be closed immediately. A quick contract award to the winner is followed by a concise debriefing to those not selected. Sellers should be thanked for their participation and invited back to bid on future business opportunities. Then, the buyer may begin negotiations with the chosen vendor on particulars to sweeten the deal, which is succeeded by contract management and related activities.

Subsequently, review meetings involving purchasing professionals and others should be held within the organization to refine the process based on the lessons learned from the ORA. Open discussion is encouraged to keep everyone informed of what is being done. Cost savings achieved should be reported and success stories should be communicated widely.

## Maintaining Buyer-Supplier Relationships

ORAs can save money for the buying firm, but they could also alienate the best suppliers (Jap, 2000). Much concern has been raised about their potential harm to the buyer's relationship with its current suppliers by sowing distrust between them (Anonymous, 2002b; Chin, 2002; Jap, 2003). In contrast, the results from a recent poll show that the Internet-based technology is not a threat to the purchaser-seller rapport (Parker, 2002). In fact, the ORA is considered to be a good wake-up call to the supply base provided that it is not overused (Kwak, 2002). The key to the difference between the two opposite views lies in the implementation strategy and communication effectiveness. Some useful guidelines for maintaining or even strengthening the buyer's tie with its suppliers are presented below.

In order for ORAs to be successful, they should be used strategically and the pros as well as cons must be weighed prudently. For instance, an initial ORA may be held to reach a wide range of sellers, gain a sense of market pricing, and send a strong message to complacent incumbents. It may then be followed by the development of long-term sourcing arrangements, through which the suppliers are more willing to work closely with the buyer to lock in the business. Over time, such carefully crafted and managed relationships can be a major source of competitive advantage and may generate enormous profits for both parties. Davies (2002) argues that if the buyer lets the sellers know what is being done and why, they will understand and most, if not all, will support the initiative. Their worries may be alleviated by adequate education, transparent communication, and proper implementation of the new electronic acquisition technique.

According to an analysis of the car industry, the ORA does not impair long-term buyer-supplier relationships (Parker, 2001). Rather, many suppliers strive to build stronger ties with the buying firm in the hope of avoiding future auctions. Owens Corning attempts to counter any potential negative effect of ORAs by pooling its needs so that both the incumbents and new sources can gain some extra business (Moozakis, 2001a).

## CONCLUSION

A large number of studies have demonstrated that ORAs not only improve the buyer's purchasing efficiency, but also reduce its overall procurement costs (Moozakis, 2001b). Sellers also benefit from new business opportunities to increase their sales. The online tool speeds up the acquisition process significantly and offers a degree of information transparency that cannot be achieved with the traditional procedure (Bettley, 2001). Incumbents don't get preferential treatment and there are no private negotiations, bluffs, or skills. In spite of the positive effects of ORAs, care must be taken and sensible judgment should be made in using them to fully exploit their potential.

### Some Caveats

An ORA is not a substitute for solid purchasing practices; it is merely a supplement to the established modes of buying and selling. Due to its inapplicability to some buys as previously discussed, it cannot be expected to be a dominant tool or serve as the standard way of doing business in supply management.

Michaels (2001) and Newton (2001) warn that while the ORA may deliver good results, it can be a cause for concern or even a disaster. The actual savings from ORAs could be much lower than projected (Emiliani & Stec, 2001b; Kalin, 2002). This is because some hidden or less obvious costs may not be properly reflected, such as the expenses for re-sourcing and scheduling extra trips to keep tabs on a new supplier's performance.

Lastly, it should be pointed out that not every organization is ready to jump on the bandwagon or cheer the arrival of the ORA. As an example, IBM has not embraced it to date (Anonymous, 2002b) and many businesses have put off conducting online events due to fear and uncertainty (Dalton, 1999).

## Managerial Implications

This study examines several key dimensions of the online reverse auction and we believe that it has tremendous implications for supply managers. For instance, the introduction to the history and the taxonomy of the ORA provides procurement professionals with a sound understanding of the evolution as well as the variety of the new buying tool. Moreover, the advantages and disadvantages to each of the buyer and the seller are discussed extensively in the paper. Business concerns or government agencies interested in ORAs should carefully weigh the pros and cons before a commitment is made. Once management has decided on the adoption of the Internet-based approach to buying goods and services, the 10 important considerations presented in the second half of this manuscript may serve as a roadmap to help an organization develop its ORA program. It has been well documented that closely following the suggested guidelines will ensure successful implementation of the electronic purchasing system and eventually lead to substantial savings in material costs.

## Future Work

The emergence of ORAs offers many exciting research opportunities for academicians and practitioners alike. The work presented here aims to provide an overview of this increasingly popular procurement paradigm. However, it should be viewed only as a first step towards a better understanding of the ORA to tap its full potential in the dynamic field of supply management.

Despite the fact that the 10 important factors proposed by us have been validated by three senior purchasing managers from different industries, our immediate goal is to build a theoretical model and subsequently survey companies with significant experiences in ORAs to empirically test their criticality. In the longer term, we plan to direct future efforts to the following five related areas to online reverse auctions: documentation and classification of ORA success stories, use of ORAs in the public sector, a comparative study of cost savings or efficiency improvements from different types of ORA, impact of information transparency on the bidding behaviors in an ORA, and mathematical modeling of the sniping phenomenon in the ORA.

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