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Electronic Reverse Auctions - Success Metrics & Dynamics

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Abstract: This paper describes an on-going study analyzing thousands of electronic procurement auctions conducted by a large multinational firm. We describe the challenges of developing metrics for auction success and auction dynamics and how these metrics improve our ability to model, understand, and manage this domain. Since we are in the initial stages of our study and since many of our findings are confidential, this paper is limited to describing the metrics and the relationships investigated between supplier experience, supplier participation levels, late bidding behavior, and electronic reverse auction success. By the time of the presentation, we expect to obtain permission to reveal more details about our findings.

1. INTRODUCTION

Online auctions are rapidly increasing in popularity and importance (Gaudin, 2000; Lucking-Reiley, 2000; Rupley, 2000; Shaw, 1999). While the business-to-consumer (B2C) has been the most popular category of online auctions, business-to-business (B2B) online auctions are emerging as a prominent business model (Rupley, 2000). In 1999 alone, B2B online auctions totaled $109 billion worth of transactions, and that number is expected to grow to $1.3 trillion by 2003 (Gaudin, 2000).

Within the category of B2B online auctions there has been rapid development of reverse auctions (Turban et al., 2000) and many companies are achieving substantial savings through such online procurement auctions (Brunelli, 2000; Schwartz and Mendel, 1999). In reverse auctions the buying company hosts the online auction and extends invitations to potential suppliers to bid on announced request-for-quotations (RFQs). The supplier with the lowest price wins the contract.

While B2B procurement auctions are clearly a significant phenomenon, there is a dearth of empirical research on the performance and dynamics of these auctions. In order to support such empirical research, metrics for online auction success and related factors must be established. This paper describes the type of metrics and analysis used in studying thousands of electronic procurement auctions conducted by a large multinational firm.

Since we are in the initial stages of our study and since many of our findings are confidential, we limit our discussion to a description of the metrics and the relationships investigated between supplier experience, supplier participation levels, late bidding behavior, and electronic reverse auction success. We begin by describing auction success metrics. We then turn to supplier participation metrics, supplier experience metrics, and late bidding behavior metrics. The paper concludes with examples of how these metrics can help us research, understand, and manage electronic procurement auctions. By the time of the presentation, we expect to obtain permission to reveal more details about our findings.

2. AUCTION SUCCESS METRICS

As one of the reviewers of this paper pointed out, measuring auction success is an important yet elusive task. The reviewer observed that success should be measured as the auction effectiveness at finding the optimal market price. Since optimal market price is typically an unknown, we must rely upon surrogate measures.

A typical approach is to measure reverse auction success in terms of price reduction for the product or products included in the procurement process. This metric, as one of the paper reviewers pointed out, is far from ideal, since further auction cycles for the same product would probably fail to generate similar price reductions. However, since we are currently in the early stages of applying online procurement auctions and since reporting of price reduction holds an obvious appeal to management, it is the metric of choice in current literature.

For example, the Navy officials in NAVSUP estimate a 28.9% savings off the purchase price for their components through reverse auctions (Anonymous, 2000). Similarly, Quaker Oats reports millions of dollars in savings by purchasing via reverse online auctions (Brunelli, 2000). However, it is not clear how these savings should be measured.

In many cases, the purchased item has no prior price or no prior price at the same purchase volume. Furthermore, prior purchase prices may fail to reflect existing market and production conditions. For example, the cost of raw materials or components can change dramatically over a short period. In our case study, the corporate buyer sets a starting bid for the auction, a price that may be below the prior contract price and is expected to reflect current market conditions. However,

we have to assurance that the starting bid price set by the corporate buyer is a realistic and unbiased estimate.

In short, while measuring auction success can be accomplished by comparing the winning lowest bid price to a reference starting price, we must select from a number of alternatives for identifying the reference starting price. In our case study, we have identified three main alternatives for a starting price reference point: a) the staring bid price set by the corporate buyer, b) the actual price paid by the corporation in the last purchase of that product or service, and c) the first or highest bid price submitted during the auction.

As discussed above, the first two alternatives can result in missing or biased reference points and hence we elected to use the difference between the maximum and minimum bids as the main measure of auction success. It should be noted however that we found very high correlations between the three alternative measures of auction success.

Once a measure of auction success is established, we found a large number of interesting correlations between auction success and various factors. The rest of the paper will discuss three of these factors.

3. SUPPLIER PARTICIPATION METRICS

Theoretical and empirical analysis of traditional auctions has clearly established that more bidders will improve the winning bid (see, for example,Brannman et al., 1987). However, our analysis of B2B procurement auctions suggests that bidder participation is a multi-stage process and that each stage is critical to developing effective auction participation rates. We developed a set of metrics to measure the level of participation response at each of these stages. These metrics include measures such as: a) number of suppliers invited, b) number and percent of suppliers who accepted the invitation, c) number and percent of suppliers who actually logged in to the online reverse auction site, d) number and percent of suppliers who actually submitted bids, and e) number of actual bids.

Statistical analysis shows that all of these metrics are significant factors in explaining auction success. We then discovered various factors that can explain and even influence supplier participation levels. For example, by inviting an optimal number of suppliers to an optimally sized auction, conducted over an optimal time window, auction success may be improved.

It was during that phase of the investigation that we asked ourselves if supplier experience in online auctions could be a useful predictor of participation levels and auction success.

4. SUPPLIER EXPERIENCE METRICS

Bidder experience has been recognized by prior research as an important factor in investigating auction dynamics (Andreoni and Miller, 1995; Kagel, 1998; Phillips et al., 1991; Wilcox, 2000). Since we had no access to information about supplier experience in B2B procurement auctions in general, we considered metrics that measure participation experience as reflected by the data set of the corporation itself. This was facilitated by the fact that the data set included the participation and bidding history for thousands of online auction events.

Using our data set, supplier participation experience could be measured in a variety of ways: a) number of times a supplier accepted an invitation to participate, b) number of times a supplier logged in to previous auctions, c) number of bids submitted by the supplier in previous auctions, and d) number of previous auctions where the supplier submitted the winning bids. The number of auctions previously won by a bidder has been used by Wilcox in a recent empirical investigation of eBay auctions (2000). However, this measure seems overly restrictive and was probably used due to lack of alternative data. We have no conclusions yet about which of these alternative metrics is the most significant, but we have several initial findings.

Our preliminary investigation focused on the experience metric of number of times a supplier has logged-in to previous auctions. We found a significant correlation between average level of supplier experience in each auction and the success of that auction. We also found that different levels of supplier experience resulted in different auction dynamics, such as late bidding behavior.

The significance of these findings is that corporate buyers can influence the level of experience in the bidder pool since they invite specific suppliers to each auction event. By providing the buyers with guidelines about optimal average experience level for each auction type and experience level profiles for each supplier, the buyer can manage the invitation process to produce a supplier pool that is closer to prescribed levels of experience. For example, if the invited pool of suppliers is too inexperienced, an exception report can alert the buyer to that fact.

5. SUPPLIER SUITABILITY METRICS

One of the reviewers of this paper correctly observed that supplier suitability to provide the requested product or service is a major factor in determining auction success. Due to lack of data on supplier suitability, this factor was outside the scope of our initial investigation. However, we hope to address this issue by suggesting to our case firm that suitability metrics be subjectively assigned by the buyers as they invite each supplier to participate in the auction.

6. LATE BIDDING BEHAVIOR

Late bidding behavior occurs in reverse auctions when suppliers submit bids towards the end of the auction time window. Theory and empirical research indicate that in auctions where the buyer is uncertain about the value of the purchased item, late bidding behavior arises (Milgrom and Weber, 1982; Wilcox, 2000). One reason for this phenomenon is that by delaying their bids, participants can use pricing information in other bids as a mechanism for gathering information about the common value attributed to the auctioned item by others.

In the case of reverse auctions, we can apply symmetrical reasoning and expect more pronounced late bidding behavior when suppliers are uncertain about the cost or risks involved in producing the requested item. Our initial findings indicate that indeed late bidding behavior is a significant phenomenon in B2B reverse auctions. It is correlated with auction success and is influenced by a variety of factors, including supplier participation levels, supplier experience, and product type.

Simple metrics of late bidding behavior include number and percent of bids submitted in the last period of the auction time window. These metrics show significant correlations with the factors above. However, more sophisticated metrics of late bidding behavior show even greater promise in clarifying auction dynamics.

7. CONCLUSIONS

While we are only in the initial phases of our research, work is already in progress within the corporation to apply the metrics and initial findings to the management and control of online procurement auctions. The objective is to carefully adjust factors that are under management or buyer control in order to increase auction success.

Future research is needed to test the applicability of our findings to other organizational and auction type settings. For example, will auction participation dynamics and their relationships to auction success change significantly once much of the profit margin has been squeezed out due to repeated auction cycles? Price savings in initial auctions may capture reductions in both transaction and production costs. However, price savings in subsequent auctions must be generated almost exclusively from continued efficiencies in production, and from the inclusion of newer, lower-cost suppliers.

Future research is also needed to expand the number of success factors modeled and investigated. Factors such as trust, security, auction web site content, design and features were outside the scope of our initial investigation.

Online auctions provide a unique opportunity to apply theory, data mining techniques, and information technology to the development of better models and

understanding of auction dynamics. We hope that this paper contributes to our ability to address this research agenda.

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