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"Procurement Reverse Auctions: Case Study of a Tender for Natural Gas Supply"

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Premise

Generally speaking, it is only within the last twenty to thirty years that the Procurement Function, both in public institutions and private enterprises, is considered just as "strategic" as other business functions (e.g. Sales and Marketing). For some reason, making profits or adding value always focused more on revenues than costs, both in academic and work environments.

Even today, the big question of "how to make more profits" would likely first consider sales and only then savings. This type of thinking may explain why, in terms of the organizational structure of a business, the Procurement Function often fell within the wider area of Administration, separated from the more business-oriented, or strategic functions. In fact, the Procurement (Purchasing) procedure was really elementary. For example, if a department, office or internal client required furniture or stationery a simple request was made to Procurement to buy it. Purchase choices were not grounded on economic theory and strategy based on academic studies or models, but rather on the buyer's negotiation "ability", contingent considerations and common sense. Therefore, at that time, Procurement activity was conducted without taking into account concepts such as Best Value for Money, open, transparent, fair and ascertained competition. In this regard, the application of Micro-Economic theory to Procurement activity may be considered as relatively recent (at least from an empirical prospective).

While today the terms "Procurement" and "shopping" are no longer synonymous, a Strategic Procurement consciousness has developed, and in this context, the use of Reverse Auctions may be seen as an important aspect in its on-going evolution.

If the literature on Procurement methods and procedures in general is relatively "young", the specific application of Reverse Auctions to Procurement may be seen as "just born".

In the past two decades, only a small percentage of Procurement agents have been using Reverse Auction as a Procurement method on a regular basis. In fact, even though it is widely accepted that reverse auction works in saving organizations costs and time during procurement operations, it is much less clear why, how and when they work. The empirical research studies in this area are few, and most of them are only descriptive and conceptual in their nature (Wagner and Schwab, 2004). This scarcity of empirical studies may be attributed to the limited availability of data (mostly based on qualitative interviews and case studies) and to the "impurity" of their nature.
Moshe, Shalev and Asbjornsen (2010) have found that most studies, focusing on the factors that affect e-Reverse Auctions success in the public sector, primarily rely on surveys and case studies to support their conclusions.
Therefore, there are few available data, and in most cases they cannot be generalized given their specificity (the sample sizes have been too small). Moreover, it is not so easy to isolate the forces in place and the related successful factors; indeed, there are many aspects and contingencies playing a role in costs reduction.
During a reverse auction, where do savings come from? Which is the factor that most affects savings?
We can already anticipate that both the power of competition (by information increasing) and the electronic automation of the process play a role in costs reduction. As often, the question takes the form of "give to Caesar what belongs to Caesar".

Abstract

The aim of this thesis is to analyze the advantages and the possible drawbacks in utilizing reverse auctions in procurement tenders. After providing some definitions of reverse auctions and explaining how they are located within the procurement process, I will report some data concerning the spread in the utilization of this procurement method in both public and private organizations. In Chapter 2 I will examine in depth the concepts of uncertain information and competition within the auction, together with the different types of auction formats and related pros and cons. In Chapter 3, I will look at the circumstances in which procurement reverse auctions should and should not be utilized by organizations. Finally, I will introduce the case study of a Gas Furniture tender conducted with a reverse auction method, which I personally followed during my work experience at the International Fund for Agricultural Development (IFAD).

Within this work, the Reverse Auction and Procurement process are seen primarily from a public buyer's point of view.

Keywords: *Reverse Auctions, Procurement, Tendering Methods, Invitation to Bid, Uncertain Information, Competition, Buyer Strategy, International Organizations, Cost Savings, Supply-Chain Efficiencies, Bidders Strategic Behaviors, Games and Contract Theory, Purchasing.*

Summary of the Chapters

In the **first Chapter**, I give the definition of reverse auction: *a dynamic competitive tendering exercise where bidders compete by lowering price (increasing applicable discounts) at certain intervals*. Reverse auctions represent a sub-method for submission of offers when the ITB (Invitation to Bid) method is chosen. Reverse auctions are a practical application of Games Information and Contract Theory. In particular, the auction event is a sort of "*Prisoner's Dilemma*" situation, in which, in condition of imperfect information, some agents (the bidders) may choose to compete or to behave strategically.

The degree of the auction dynamicity (in terms of the total auction timeframe, price reduction size and interval size), and the criteria for determining the "winner", identify different auction types. The auction may take the form of *single unit* (or predetermined fixed quantity) or *multiple unite* auctions. The auction may have or not a *reserve price* or a *minimum bid*.
These variations include Multi-round descending auctions (English auctions; Anglo-Dutch auctions; Descending clock auctions; Survival auctions) and Simultaneous descending clock auctions (Accommodating discrete rounds with intra-round bidding; Clock proxy auction; Vickrey auctions; Japanese auctions).

Although it is widely accepted within the literature that reverse auctions work in saving organizations costs and time during procurement operations, however it is much less clear why, how and in which circumstances they work.
The objective of my work is to answer to the following questions with regard to the use of reverse auctions in procurement:

- Where do savings come from? Or, in other words, which are the factors that mostly affect the savings?
- Which are the drawbacks?
- What are the circumstances and conditions in which reverse auctions should, or should not, be utilized?

The main point in the current literature is that reverse auctions produce price savings by strengthening the competition and by increasing the level of information of the bidders. In addition, many studies reported supply chain efficiencies and administrative time savings for the organizations as a result of the use of reverse auctions.

I have studied the auction's goals, the possible competition gains and its efficiencies and drawbacks. In addition, the trade-off between information-spreading and risk of bidders' strategic behaviors when building the auction's format is investigated.

My approach case-study based: after discussing the current literature, I compared my professional and practical experience against the theory.

I reported the literature concerning the types of savings one should expect when using electronic reverse auctions. In this contest, I tried to separate the *role of the competition* from the one of the *electronic (automatic) tool*. I have also studied the risk of collusion and, more generally, the impact that the reverse auction method (compared to the traditional sealed bid format) may have on the level and quality of competition.

In the 2nd Chapter, I analyze in details the Micro-Economic aspects behind the auction and, in particular, the issue of the *uncertain information* between buyer and bidders (and among bidders) during procurement tenders.

Dimitri, Piga and Spagnolo (2011) explain and provide practical suggestions about the choice between a classic sealed-bid tender versus a dynamic auction. They analyze the nature of the costs that competing bidders suffer in terms of imperfect information, both during the bidding phase and after the contract award (the *winner's curse phenomenon*). They also advise on how to set up the auction format taking into consideration the *trade-off* between the duration (time, staff and administrative costs) and the information increase produced by the auction.

There are two different sources of uncertainty for the bidders when estimating the cost of the contract to be performed and the subsequent bid's choices:

- *The private cost component:* specific firm's efficiency in terms of internal knowhow, experience, managerial and human resource skills.
- *The common uncertainty*: supplier's ability to understand and estimate the contract to be performed in case of award.

One of the implicit (and reasonable) assumptions is that reducing the above mentioned costs would increase the level of information that in turn will strengthen competition and decrease the award price.
In fact, the presence of these uncertainty costs produces some extent of "winner's curse". This phenomenon occurs when suppliers face uncertainty about the composition of the final demand. In other words: *when he finds out that the real cost of performing the contract differs from his initial estimation*.
Furthermore, the cost of "winner's curse" is somehow transferred from the bidder/contractor to the buyer/organization in two different ways:

1. Ex-ante: if the supplier is aware of the "winner's curse" before bidding, it may decide to underbid and this in turn means high award price.
2. Ex-post: if the awarded company finds out, only after the tender, that he suffered of "winner's curse" , it may behave opportunistically by reducing the quality of the service/product provided.

How can the buyer avoid, or at least reduce, the risk and the impact of the "winner's curse"? More generally, how can the buyer reduce costs related with the uncertainty information? The answer is straightforward: by increasing (producing) information. This can be done:

i. *Ex ante* (before bidding): by providing accurate technical specifications;
ii. During the bidding: by using the reverse action as an information producer tool
iii. *Ex post* (after bidding): by setting quality and performance assurance and indicators (e.g. KPIs).

The dynamic auction format, compared to the one round sealed bid, may generate *information spreading* between suppliers. During a reverse auction, bidders can observe the behaviors of their competitors and adjust their prices consequentially. The action serves as learning tool for *less informed bidders* to gather information from the *more informed* ones by observing what the others do. In this contest, the timing in which the participants quit the auction represents a crucial information source for *surviving* bidders. Therefore, reducing the common uncertainty makes suppliers bid more aggressively.
However, in order to work as a *price-reducer*, reverse auction requires the specifications to be as much precise as possible.
In fact, the lower the common uncertainty is, the less is the risk of *winner's curse* because bidders will bid less cautiously and the award prices will be lowered.

With respect to the sealed bid format, the main goals of the buyer when using reverse auction should be:

1) To produce price savings by increasing the number of competitors and by strengthening competition which in turn means lower award price;
2) To produce administrative efficiencies;
3) To reduce the risk of winner's curse and so to increase the likelihood of awarding the best supplier.

All this said, reverse auctions incorporate some possible drawbacks. This because bidders could start bidding cautiously to observe the behaviors of the others.
For this reason, information circulation may increase the risk of collusion (below point 3), especially when the bidders *can split the cake* in multiple contracts auctions. Indeed, the auction platform may work as a huge communication opportunity in which the bidders can send signals between each other to coordinate their behavior (especially during the first stages of the auctions by means of signaling prices). In addition, the auction may serve as a perfect place for detecting and for punishing deviations from a collusive agreement.

There are three types of **strategic behaviors**:

1. Hiding their own information (*snake in the grass*);
2. Bluffing (*Predatory Behavior*);
3. Colluding.

The first case usually happens when there are only few bidders owning proper information about the contract. In fact, in order to conceal their information to rivals, the most informed bidders may bid cautiously at the first stages of the auction and then suddenly reduce the price at the last stage. Should this be the case, the auction would provide poor information gain.
The second phenomenon is very similar in its nature to the *predatory pricing* taking place within the competition policy and industrial organization contest: the objective of the predator (incumbent) is to appear to his competitors as the strongest, by setting over competitive prices for a certain period of time, in order to drive rivals out of the market. The same mechanism may apply during the reverse auctions where the "virtual market" is the auction itself and the predator wants to *kick* others bidders out of the auction and thus deterring further competition. We can easily note that both phenomena are caused by some sort of asymmetric information. Some bidders are more informed (thanks to previous experiences) than some others, and this allows them "bluffing". In order to avoid this, the buyer should build up an even playing field by providing as much information as possible before that the auction takes place.

In addition to the strategic behaviors, the trade-off between information production and auction's administrative time and costs (number of auction's rounds) should be taken in to account when building the auction's format. These costs are:

1. Psychological cost;
2. Cost of specialized personnel.

Some bidders may find long-lasting auctions as too stressful and/or time spending. In fact during the auction, bidders should constantly follow up with price's status/trend in order to re-formulate their bidding strategies.
In addition, if the auction is too long, bidders may face increased costs (wages) for the staffers specifically dedicated to the auction.
These two costs may discourage bidders' participation and, in turn, reduce the number of competitors.

From the buyer's side instead, the issue of the cost of specialized personnel is still debated.
On one hand, long-lasting auction may result psychologically exhausting and costly in term of specialized personnel not only for the suppliers but for procurement staffers also.

Moreover, it may be unfeasible for a small procurement office to run too many long lasting auctions at the same time.

On the other hand, some studies documented the so called *soft dollar savings* and supply chain efficiencies coming from the use of reverse auctions.
Vowler (2004), after examining the impact of reverse auction utilization by American municipal governments, affirmed that reverse auctions can significantly reduce the time required for procurement staffers to accomplish their purchases.
According to his studies, the portion of *soft dollar savings* attributable to the efficiencies coming from procurement staff productivity gains represents the 60% of the total savings. Apparently, "only" the 40% of the overall savings could be attributed to the reduced contract prices paid for the items being procured through reverse auctions method.

Schrader and Eller (2004) observed that in addition to cost savings coming from lower prices, when utilizing reverse auctions, buyers face increased productivity from their employees. Indeed, by using a standard platform for procurement process, redundancies are removed. The dismissal of traditional signing paper approvals and procedures leads to a substantial reduction in transaction processing and administrative costs.
In line with the above, Carbone (2005) defines reverse auctions as "time-saving tool" that allows requesters and buyers to focus on more value-added functions that handling bids, paperwork, and routine communications.

All this considered we can now reply to the questions raised before: which kind of savings and which drawbacks should we expect when utilizing reverse auctions?

The **SAVINGS** are:

1) **Hard dollar savings**

- Lower award price: competition is strengthened by increasing (producing) information: during the auction, the less informed (experienced) bidders gather information about the contract by observing what their rivals do and they revise their bidding strategies accordingly by bidding more aggressively;

- Lower risk of winner's curse: increased likelihood of selecting the most efficient firm because the bidders bid more consciously.

2) **Soft dollar savings**

- Supply Chain Efficiencies;
- Time required for procurement staffers to accomplish their purchases is reduced;
- Auction as a "time-saving tool" that allows requesters and buyers to focus on more value-added functions.

The possible **DRAWBACKS** are:

1) Bidders' strategic behaviors (hiding information, bluffing, collusion)
2) Bidders' Psychological Costs

In **Chapter 3**, I describe which are the circumstances and conditions in which reverse auctions should, or should not, be utilized. In this contest, it is pointed out that specifications are crucial for a successful reverse auction. The literature suggests that reverse auctions should be utilized for procuring high standardized and easily "specificable" goods/services. This because the more the bidders know about the subject of the tender (ex-ante information provided with the specifications) the more the auction works in terms of increasing competition and reducing the award price.

In the **last Chapter** (4th), I analyzes the Case Study of a *Gas Furniture* tender, an Invitation to Bid conducted with multi-stage reverse auction (three rounds). While the auction itself lasted for approximately three hours, the complete exercise took one entire working day. The crucial aspects of the tender were the level and type of information owned/provided by/to the bidders. While the specifications provided were precise and unambiguous, the information about the auction and its timing and rounds was limited.

We can say that the buyer "played" with information: while the technical specifications provided were precise and unambiguous, the information about the auction itself was limited. In fact, we "only" informed the bidders that an auction might have taken place. However, we did not specify the number of rounds, nor the auction's mechanism or its timing. As per tender document: "*organizations reserve the right to request, within the day of the closing date, improvements (reductions) of the bids received, to be submitted by fax*".

Surprisingly or not, in our "customized English auction" we might have increased competition and avoided strategic behaviors by putting some extent of uncertainty into the auction.

This choice was critical. In fact bidders did not have the chance to behave strategically because they did not know when the last round would have been occurred. However, bidders might have suffered psychological costs and specialized staff costs.

The combination of these two information aspects worked in terms of:

- Strengthened competition
- Active participation of small/new firms
- Price savings with respect to:
    - Previous year contract price (4.57% savings) and
    - The hypothetical price it would have been paid if a sealed format was preferred (2.4% savings)
- Increased likelihood of selecting the most efficient firm (lower risk of bad selection and winner's curse)
- Limiting information hiding
- Limiting Collusion (by price signaling)

However, inappropriate auctions channels might have caused:

- Administrative costs;
- Bidders' psychological costs and
- Staffer's inefficiencies.

Summarizing, how can the auction be improved?

- By using a proper auction platform;
- By informing bidders at each round about the lowest bid.

The outcomes of the case study confirmed the theories of the current literature. Furthermore, an interesting buyer's strategy came out: not providing information about the auction format (rounds) to the bidders has proven to work in reducing the risk of strategic behaviors.

CONCLUSIONS

Normally, reverse auctions work. They do work in producing two types of savings: the “hard dollar” savings coming from the enhanced competition (information) between bidders and the “soft dollar” savings coming from administrative efficiencies. However, conditions apply. The good/service being procured should be highly standardized and not too complex. Contracts involving complementary services (e.g. after-sales services) should not be auctioned. Even for the procurement of simple goods, the specifications should be precise and unambiguous in order to provide the bidders with as much *ex ante* information as possible. Indeed, bidders must know what they are bidding on. To use the auction as information-provider tool, the buyer should disclose the information about the current leading bid at each auction’s rounds. The case study confirmed that the choice to not inform bidders about the auction’s format and timing was a successful strategy. Indeed, this kind of uncertain information worked in limiting bidders’ strategic behaviors such as bluffing and colluding. When building the auction’s format, the trade-off between information-spreading and risk of bidders’ strategic behaviors should always be taken into account by the buyer. A suitable and efficient electronic auction platform should be used for avoiding administrative costs for both buyer and suppliers. Concluding, in order to strengthen the competition the buyer should make the bidders perfectly aware of what they are bidding on without revealing when the last round will take place.