

## Chapter 7

# E-Procurement Process: Negotiation and Auction Approaches for SMEs

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### ABSTRACT

*E-procurement transactions in Business to Business (B2B) environment showed a constant and positive trend in the last years. The most popular methodologies to support these tools are all related to dedicated protocols able to facilitate the agreements among customers and suppliers. This chapter proposes a Multi Agent Architecture integrated with several multi-attribute auction mechanisms specifically designed to support the e-procurement processes. Moreover, differently from other cases proposed in literature, the suppliers' proposal formulation is strongly influenced by their production plans. A simulative environment has been developed in order to evaluate different performances: the customer and suppliers' utilities, the profit distribution among the involved agents and the time necessary to reach an agreement. The mentioned approaches are compared with a negotiation process. The simulation results highlight the weakness and strength points of each auction protocol and why they can be considered as a relevant tool in B2B environments.*

### INTRODUCTION

The growth of Information and Communication Technologies (hereafter ICT) changed the way the enterprises do their business. Among the newest procurement mechanisms, auction and negotiation

are the most used in B2B transactions. The procurement process in B2B involves buyers that require good or services and suppliers that can provide them. Generally, this is a multi-attribute process and it includes variable as price, volume, due date, quality, etc. Electronic procurement (hereafter e-procurement) is the procurement process performed through ICT and network systems. The

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benefits of e-procurement compared to traditional procurement process can be summarized as follows (Favier et al., 2000; Ordanini et al., 2004):

- A higher number of suppliers can be involved in the process;
- A strong reduction of transaction costs could be reached (both considering purchasing and processing costs);
- More rapid information flow on inventory is possible because of the reduction of stock levels and, therefore, of the inventory costs;
- An increasing level of service to the customers as a consequence of all the previous point.

To reach these results, Multi Agent Systems (hereafter MAS) are the most common technology utilized to sustain the e-procurement processes. An agent is defined as an autonomous problem solving unit that may collaborate with other agents and that tries to achieve optimized results in its problem area (Bradshaw, 1997; Turowski, 2002). In e-procurement applications that technology is the most appropriate tool to be implemented in order to make transactions able to take into accounts both buyers and sellers' identities and goals, providing a better global satisfaction (Favier et al., 2000). Generally speaking, the dispute among buyers and suppliers has been mainly solved by using two approaches: negotiation and auction. Negotiation can be defined as a form of decision making process where two or more parties jointly search a space of possible solution with the goal reaching a deal (Rosenschein and Zlotkin, 1994). An electronic negotiation protocol is a model of the negotiation process in which at least some activities are supported or performed by information systems and the remainder is conducted with an electronic medium. The protocol may be complex and with many rules governing the parties as they move through different stages and phases of the process. Typically, designers try to achieve

certain goals for the outcome of a negotiation and for the negotiation process itself, such as, Pareto optimality of the result, maximization of the bid taker's revenue/utility, stability, and speed of convergence (Raiffa, 1996). These objectives are achieved through:

- Specification of the structure of the negotiation problem and process,
- Specification of rules of feasible activities, and their sequencing and timing; and
- Imposition of limitations on the form and content of information exchange.

Every electronic negotiation protocol restricts the negotiators' freedom in order to meet one or more of the above objectives. Generally, the following parameters are used to evaluate the results of the negotiation:

- **Time:** Negotiations that end without delay are preferable to negotiations that are time-consuming. It will be assumed that a delay in reaching an agreement causes an increase in the cost of communication and computation time spent on the negotiation. We want to prevent the agents from spending too much time on negotiation resulting in not keeping to their timetables for satisfying their goals;
- **Efficiency:** It is preferred that the outcome of the negotiations will be efficient. It increases the number of agents that will be satisfied by the negotiation results and the agents' satisfaction levels from the negotiation results. Thus it is preferable that the agents reach Pareto optimal agreements;
- **Simplicity:** Negotiation processes that are simple and efficient are preferable to complex processes. Being a "simple strategy" means that it is feasible to build it into an automated agent. A "simple strategy" is also one that an agent will be able to compute in a reasonable amount of time;

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