

A Multi-attribute Reverse Auction Decision Making Model Based on Linear Programming

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Abstract

Because of the popularity of the Internet, e-commerce is used more and more widely around the world. At the same time, the business style of procurement has also changed a lot. Under this circumstance, online reverse auction came into being. Based on the theoretical knowledge and practical status quo, this paper has studied some key issues, such as the applicable conditions and the basic process of multi-attribute reverse auction, especially focused on the mechanism of decision-making in the process of performing multi-attribute reverse auction. Again in this paper, AHP method has been employed to determine the weight of each attribute; moreover, based on the linear programming theory, a multi-attribute reverse auction model has been established. Finally, a calculation example has been conducted to demonstrate the utility and availability of the model.

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Keywords: reverse auction; decision making; AHP; linear programming

1. Introduction

At the end of 2010, Geoffrey Boyd, who comes from the reverse auction website Priceline, has won the 2010 year's "wealth creator" by the Journal of *Chief Executive Officer*, which implies that the reverse auction contains infinite business opportunity. According to a survey launched by e-Bay, a successful reverse auction can reduce the cost level of procurement between 6.3% and 43%, averagely 18%. However, the practice of reverse auction is far more on top of its theories, which are quite conceptive and scattered. Jap (2002) argued that the motive for a business to take reverse auction comes from saving money, enhancing efficiency and application of emerging technology [1]. From the perspective of supply chain, Wu and Li (2007) scrutinized why and how the reverse auction can reduce total cost [2]. Moreover, Stephan and Andreas (2004) proposed that the exact specification of product, sufficient preparation of buyer as well intense competition between suppliers are the key elements to determine the success of reverse auction[3]. Additionally, Bichler (2002) defined multi-attribute auction as one kind of auction patterns in

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which more attributes other than price should be considered [4]. Dekrajanpetch (2000) firstly attempted to employ the linear programming method to solve multi-attribute on-line auction problems [5]. Enlightened by the previous theoretical tools and based on the demand of current practice of reverse auction, this paper established a quantified multi-attribute model to disclose the inherent mechanism of decision making in the process of reverse auction, which is intended to facilitate the stakeholders to optimize and expedite their decision making as well take appropriate actions.

2. Basic theory of multi-attribute reverse auction

2.1. The connotation of multi-attribute reverse auction

The so-called reverse auction is opposite to daily said auction, namely, it is an on-line bidding mechanism, in which a buyer and many sellers are involved. Besides price, many other attributes in the purchase (including the quality, delivery date, supplier prestige, etc) are taken into consideration. Moreover, many factors could affect the establishment of multi-attribute reverse auction mechanism, such as : 1) the contents and types of goods or services; 2) ways of trading, including B2B, B2C, GC or C2C; 3) buyer's preference; 4) approaches of tender; 5) degree of matching between buyer and sellers; 6) feedback of both buyer and sellers.

Compared to traditional personnel purchase mode, reverse auctions have great advantages, such as: 1) seeking tenders and bid via Internet can increase transparency of the trading, save communications costs and time greatly and offer more choices for buyer; 2) reducing goods' price and enhance its quality effectively and cutting costs of transaction costs to a lowest level; 3) facilitating to eliminate regional differences. As to the multi-attribute reverse auctions, it can overcome the drawbacks of previous pattern of transaction, in which price is the only factor to be concerned about, and lead to an optimal match between demand and supply.

Nevertheless, multi-attribute reverse auctions are not appropriate for all purchase activities, especially for those under the circumstances that the internet system is not well developed and credibility system is not cultivated sufficiently.

2.2. Specific process of multi-attribute reverse auction

In a reverse auction activity, a buyer should make a thorough preparation in advance to make a reasonable decision, and perform controlling and monitoring in the process timely to attain an acceptable result. After the auction activity is finished, the buyer should summarize related experiences to make a better decision next time. Generally speaking, the steps of a typical preparation for the auction mainly include: 1) determining products' attributes and describing them exactly; 2) selecting appropriate professional website referred to e-commerce; 3) releasing demand information to the website timely and properly. In a bidding activity, the buyer should monitor the whole process timely, once he or she finds a malicious bidding (a cheating bid) or discrepancy, he or she should take remedial measures immediately to rule out the bidders or terminate the bid. The holistic process of multi-attribute reverse auction is illustrated in Fig. 1.

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